Recycling Study Guide

Table of Contents

WISCONSIN DEPT. OF NATURAL RESOURCES

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Introduction

To Educators

Is it your turn to take out the trash? Pile your trash with all the food scraps, paper, old chairs, bottles and other solid waste generated in Wisconsin every year, and you get 4.6 million tons of stuff.

Fortunately, we started recycling in the 1990s, and one third of the trash we generate is recycled. Unfortunately though, the amount of waste we're generating is growing twice as fast as our population, and our recycling rate is not keeping up with the increased generation of trash. That's why we need to teach kids about recycling and introduce them to the concept of waste reduction.

This study guide is intended to help you and your students understand what solid waste is, where it comes from, why it's a problem and what can be done about it. The guide includes an overview of solid waste and recycling, a glossary, suggested activities and a list of resources.

Consider talking with your students about solid waste, recycling and waste reduction before beginning your lessons to learn what they already know and think about it. Where are their trash and recyclables taken? Have they ever visited a landfill? What did people do before there were plastic bags, aluminum cans or trash removal services? Do people in other countries make as much trash or recycle as much as Americans do? By finding out your students' thoughts and opinions, you can help them connect new concepts with what they already know.

The activities in this guide have been designed for use in grades 4-12. We also have the **K-3 Supplement to the Recycling Study Guide, Waste Reduction: Thinking More About Less,** and **The Fourth "R": An Action Booklet for Recycling in the Classroom and School.** We encourage you to tailor the activities to meet your students' needs. You are welcome to revise and/or reproduce any part of this guide for distribution to students and other educators.

Note:

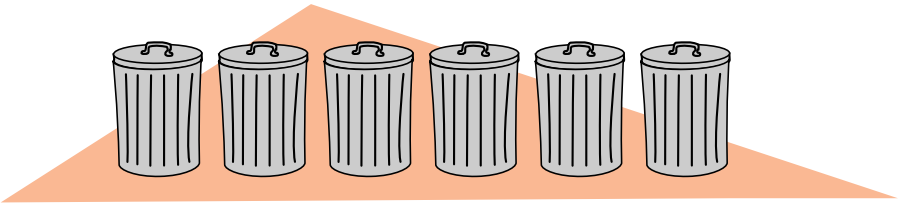
- Words that appear in italics are defined in the glossary.
- Sections marked with ☆ are based on materials from *A-Way With Waste* curriculum guide, a program of the Washington State Department of Ecology (see Resources).

Sizing up solid waste

People in Wisconsin throw out everything from toothpaste tubes to old TV sets, food scraps to plastic bags, computer games to oil filters. If you added up all the waste from your house, from the store where you shopped and from the restaurant where you ate, it would amount to 4.7 pounds per person of municipal solid waste thrown into the trash every day. Multiply that by 365 days per year, then by 5.4 million Wisconsin citizens, and your results would show that Wisconsin generates more than 4.6 million tons of trash each year! This is called municipal solid waste.

4.6 million tons of trash is enough to pile a typical city street three feet deep, curb to curb, for 500 miles — more than the distance from Superior to Chicago! Or if compressed, the way it is in landfills, that much waste would bury a 200-acre farm under 28 feet of trash each year.

The previous information covers municipal solid waste – the residential and commercial waste we personally produce every day. Another category of waste is called non-municipal waste or industrial waste. This is the waste industries, power plants and paper mills generate as they produce the products we use. It represents about 9.31 pounds per person per day. The good news is… we recycle 49% of the industrial waste we generate.



Where does it all end up?

About 60% of Wisconsin's trash or municipal solid waste ends up in the state's 39 or so licensed municipal landfills (down from 1,000 landfills in 1988). A *landfill* is a place where trash is dumped, compacted and covered with dirt. Covering the trash controls blowing paper, odors, insects and rodents and keeps water out of the landfill. All of the licensed landfills in Wisconsin are sanitary landfills — designed, built and operated according to state-of-the-art standards to prevent pollution problems.

The other 40% of our trash gets *recycled*, composted or combusted with energy recovered. It's taken from your house or a drop-off site to one of the 150 or so material recovery facilities throughout the state. Here cardboard, newspaper, magazines, office paper, bottles and cans are sorted and sold to manufacturers who make new products out of them. Tires, vehicle batteries, motor oil and major appliances are also recycled, and about half the yard waste is managed "at home" by people who leave grass clippings on their lawn and *compost* leaves and herbaceous plants.

Unfortunately, some waste is still dumped along roadsides, on the "back forty" or in other non-approved locations. Except for household wastes discarded on the homeowner's property, it is illegal to discard or incinerate *garbage*, *trash*, industrial waste, farm chemicals and other waste in places that aren't approved by the state. Discarding waste in unsafe ways and in non-approved places can endanger the environment upon which we depend. Thus, each of us becomes responsible for what we throw away and the impact that this waste may have on our environment.

So what's the problem?

Over the last three decades, public awareness of environmental problems has increased; stricter federal regulations regarding the siting, construction, daily operation, closure and post-closure monitoring of landfills have been developed; and the amount of municipal solid waste generated in the United States has increased at a rate faster than our population growth. This combination of factors has caused the cost to operate a landfill to increase, the number of landfills to decrease and a subsequent shortage in landfill capacity in many parts of the country.

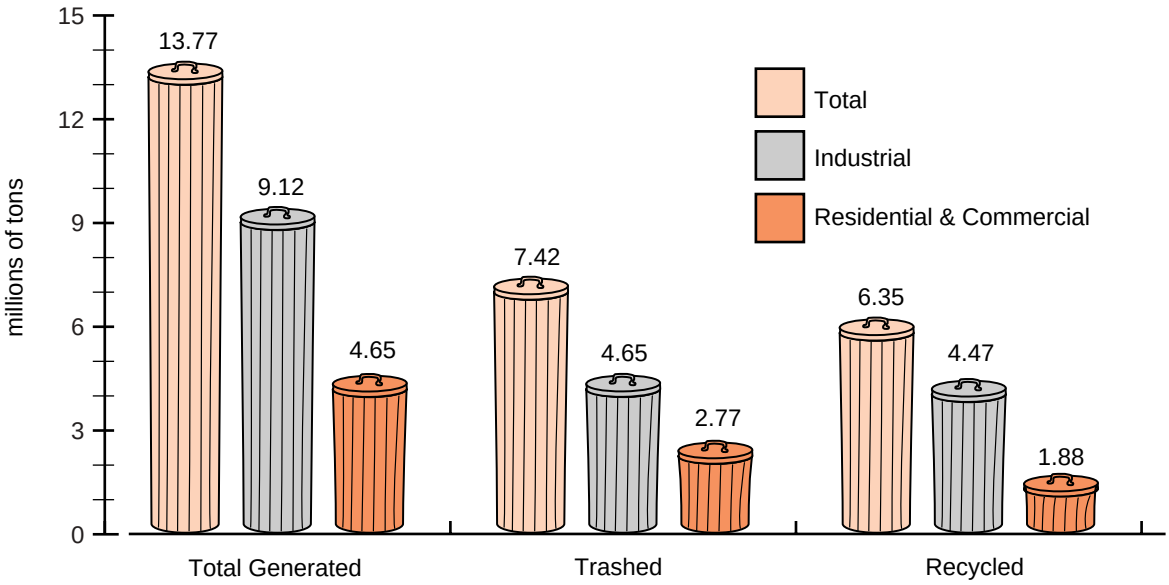
The public believes that we are running out of space for landfills. Technically, we have many sites to locate modern, sanitary landfills that will meet state and federal requirements. These new *sanitary landfills* are designed to be clean and to contain and collect *leachate* and *methane gas* that result from the decomposition of *organic* materials or the gradual breakdown of inorganic materials. However, the economics of landfill operation and the politics of landfill siting make it difficult to get new landfills built. Nobody wants a landfill located near them (see sidebar on The NIMBY Phenomenon), and everyone hates to pay more for trash disposal.

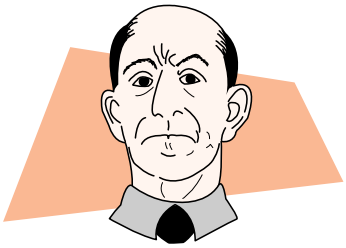
The amount of *natural resources* we throw away is another part of the *solid waste* problem that is not so apparent. Wisconsin's trash contains enough energy to heat over 350,000 homes a year, and even though we're recycling tons of metals, glass, plastic and paper, we are still throwing away a lot of valuable natural resources. We need to move beyond recycling and do more to reduce waste before it is produced.

Wisconsin's Trash Tally for 2000

Category	Material Generated	Recycled[1]	Trash
Residential & Commercial waste[2]			
Newspaper	261,710	177,780	83,930
Corrugated containers	661,580	484,370	177,210
Magazines	74,850	23,760	51,090
High grade office paper	159,710	47,490	112,220
Mixed waste paper	577,880	183,820	394,060
Aluminum beverage cans	32,950	18,400	14,550
Steel cans	55,310	30,380	24,930
Plastic containers	70,730	30,370	40,360
Glass containers	191,270	112,280	78,990
Yard trimmings	538,380	476,040	62,340
Food waste	663,860	6,500	657,360
Disposable diapers	57,450	1,530	55,920
Vehicle batteries	38,530	37,370	1,160
Tires	97,260	92,400[3]	4,860[4]
Major appliances	71,310	67,750	3,560[4]
Other waste	1,096,470	87,730	1,008,740
Total	4,649,250	1,877,970	2,771,280
Industrial Waste[2]	9,115,100	4,468,230	4,646,870[5]
Total Solid Waste[2]	13,764,350	6,346,200	7,418,150

[1] Includes materials recycled and materials combusted with energy recovery.
[2] Estimate in tons. Source: Franklin Associates, LTD.
[3] Includes 41,110 tons in temporary storage or shipped out of state
[4] Estimate at <5%
[5] Includes 1,859,900 tons landspread wastewater treatment sludge and 21,200 tons combusted





The NIMBY phenomenon

Finding places to put landfills is not easy. Few people are eager to live near a landfill, an attitude sometimes called the NIMBY phenomenon — "Not In My Back Yard!" Many people believe landfill construction and operation result in traffic, noise, dust, litter, aesthetic loss, declining property values, groundwater contamination and other hazardous waste pollution. While fears may have been justified in the past, modern landfill design, construction and management can minimize most of these problems. Unfortunately, the NIMBY phenomenon also applies to the siting of recycling centers and municipal composting facilities.

What else can we do with waste?

Wisconsin already reuses, recycles, composts or recovers energy from almost 40% (by weight) of its residential and commercial waste each year and 49% of its industrial waste (that figure would increase to 62% if you add the 1,167,300 tons of municipal waste water sewage sludge that is land spread annually). This reduces the need for landfill space, saves the cost of disposal and reuses valuable natural resources. The Recycling Law reaffirms the state's commitment to reduce the volume of discarded items by providing the following list of options for managing solid waste. The options are in order from most to least desirable.

1. Reduce the quantity of waste produced. For example, some products and packaging are designed to use less material, to be recyclable or to contain fewer hazardous chemicals. We can produce less waste through selective shopping. Also, we can encourage reduction by expressing our views about products and packaging to retailers, industry and government.

2. Reuse items. Soda bottles, old furniture, clothes, tires, appliances and automobiles or their parts, industrial shipping containers (barrels, pallets, cardboard boxes) and many more items can be reused.

3. Recycle. For instance, recycled newspaper can be made into newsprint, paper bags, cellulose insulation, egg cartons, animal bedding or cardboard. Glass and aluminum from beverage containers can be made into new containers. Cooking oils and meat fats can be made into chemicals and cosmetics, coal ash into shingles and concrete and plastic bottles into artificial lumber, carpeting and winter jackets.

4. Compost organic wastes. Gardeners know both the ease and the value of composting food and yard wastes to create rich humus that improves soil fertility and texture. Some businesses also can compost their organic wastes. For example, cheese whey, organic sludge from paper mills and sewage treatment plants and remains from processing or cleaning fish can be composted.

5. Incineration of waste with energy recovery. Each ton of solid waste has the energy equivalent of 70 gallons of gasoline — enough energy to drive a small car from coast to coast.

6. Landfill nonrecoverable items. We may always need landfills, but Wisconsin is working to reduce this need. Using the techniques described above, Wisconsin aims to cut the need for landfills.

7. Incineration of waste without energy recovery. Though this may be the lowest ranking option for disposal of waste, it is sometimes the only option for safe disposal of medical and hazardous wastes.

None of these options is the sole solution to our waste disposal problem. Each option has side effects that must be considered when we're selecting the best solution to each solid waste problem.

What can you do?

You can start by looking at what you throw away at home. Each person's "drop in the bucket" adds up to create the trash problem. If each drop becomes smaller, the problem will be reduced.

Everyone produces some waste, but you don't have to be a "superconsumer". Think about the goods, services and activities you buy or support. In what ways do they contribute to the solid waste problem? How could you purchase and dispose of items in ways that generate less trash? What can you do to voice your opinion about solid waste issues in your community?

For example, consider:

- buying long-lasting products rather than items that have a shorter life span and end up as waste sooner.
- buying goods in returnable and recyclable containers.
- learning where you can take items to be recycled and showing your support by recycling and buying items made with recycled content.
- composting food wastes, leaves and grass clippings.
- finding the people in your town who are interested in reducing waste, promoting recycling, inventing new uses for old materials and fighting litter. Work together with these people to promote waste reduction and recycling.
- taking an active interest in how your solid waste management dollars are spent. Compare your community's hauling and disposal costs with those of neighboring towns. Investigate the quality of your local landfill and measures being taken to make it as safe and long-lasting as possible.
- learning how nature recycles materials. Is much wasted?

Wisconsin's solid waste management goal is to find the best political, economic, social and personal ways to manage our waste while keeping the environment healthy. Each of us contributes to the solid waste problem. Each of us can help solve it.

Glossary

biodegradable: the property of a substance that permits it to be broken down by microorganisms into simple, stable compounds such as carbon dioxide and water. (See "decompose".)

bottle bill: a law requiring deposits on beverage containers, like aluminum cans and plastic bottles. May discourage littering and landfilling. More accurately called a beverage container deposit law.

composting: a waste management process that creates an optimal environment for decomposition by layering organic wastes like food scraps and grass clippings so they'll decay into fertile humus.

conserve: to protect from loss or depletion. Conservation is the wise use of natural resources to minimize loss and waste.

decompose: to break down into component parts or basic elements; to rot. Decomposition is an organic process necessary for the continuation of life since it makes essential nutrients available for use by plants and animals.

dump: open unsanitary disposal site used before existence of licensed, controlled burial sanitary landfills. Now illegal in Wisconsin.

energy recovery: the generation of energy by burning solid waste.

garbage: spoiled or waste food that is thrown away. Generally defined as wet food waste and excludes dry material (trash). The term is often used interchangeably with the word "trash".

groundwater: water beneath the earth's surface that fills the spaces and flows between soil particles and rock. Supplies wells and springs. Two out of every three Wisconsin citizens drink groundwater.

hazardous waste: waste that can cause special problems for living organisms or the environment because it is poisonous, explosive, burns or dissolves flesh or metal, ignites easily with or without a flame or carries disease. Some hazardous wastes have one characteristic, others have several.

humus: organic material consisting of decayed vegetable matter that provides nutrients for plants and increases the ability of the soil to retain water.

landfill: a site for the controlled burial of solid waste.

leachate: liquid that has percolated through solid waste and/or been generated by solid waste decomposition and contains extracted, dissolved or suspended materials. May contaminate ground or surface water.

litter: waste materials discarded in an inappropriate place. Littering is illegal in Wisconsin.

methane: a colorless, odorless, flammable, potentially dangerous gaseous hydrocarbon (CH4) present in natural gas and formed by the decomposition of organic matter. Can be used as a fuel.

natural resource: valuable, naturally occurring material such as soil, wood, air, water, oil or minerals.

nonrenewable resource: a natural material that, because of its scarcity, the great length of time required for its formation or its rapid depletion, is considered finite in amount (e.g., coal, copper, petroleum).

organic: derived from living organisms.

pollution: harmful substances deposited in the environment, leading to a state of dirtiness, impurity or unhealthiness.

raw material: unprocessed natural resource or product used in manufacturing.

recover energy: see "energy recovery."

recycle: the collection and reprocessing of manufactured materials for remanufacture either in the same form or as part of a different product.

reduce: to lessen in extent, amount, number or other quantity.

renewable resource: a natural resource derived from an endless or cyclical source (e.g., sun, wind, water, fish, trees, cotton). With proper management and wise use, replacement of these resources by natural or human-assisted systems can equal or exceed their consumption.

reuse: to extend the life of an item by using it again, repairing it, modifying it or creating new uses for it.

sanitary landfill: a specially engineered site for disposing of solid waste on land. Constructed in a way that reduces hazards to health and safety.

solid waste: all solid, semi-solid, liquid and gaseous wastes, including trash, garbage, yard waste, ashes, industrial waste, swill, demolition and construction waste and household discards such as appliances, furniture and equipment.

solid waste management: the controlling, handling and disposal of all solid waste. One goal of solid waste management is to reduce waste to a minimum.

source reduction: a reduction in the amount and/or toxicity of waste entering the waste stream — also called waste prevention.

trash: material considered worthless, unnecessary or offensive that is usually thrown away. Trash is generally defined as dry material and excludes food waste (garbage) and ashes. However, the term is often used interchangeably with the word "garbage".

Activities

Out of Sight, Out of Mind

Note: Read the definitions for solid waste, trash and garbage in the Glossary. For these activities, initially consider recyclables as part of the trash. Once items are identified and recycled, they will no longer be trash. See Going Beyond in Part 1.

Part 1 — My Ton of Trash

Goal: To help students visualize how much solid waste is generated for each person in Wisconsin and understand how the number of people living in our state and country affects this amount.

Subjects: Mathematics, social studies, science, environmental education, health.

Grades: 6-12

Materials:
- 14 pound bag of miscellaneous trash and recyclables. Wash containers, avoid items with sharp edges.
- gloves

Procedure:
1. Describe trash and list some examples. Discuss:
- What qualities does an item have that makes you decide it is trash?
- What different kinds of trash are there?

2. Dump the 14 pound bag of trash (and recyclables) on the floor. Discuss:
- Does this seem like a lot of trash? This much trash is thrown out each day for every person in Wisconsin.
- How do you think the number "14 pounds" was calculated? Will the number ever change? Why?
- How do you feel about the fact that you are responsible for 14 pounds of trash that is thrown out each day?

3. Calculate:
- If you generate 14 pounds of trash each day, how many pounds do you make every week, month and year?
- Convert the annual number from pounds into tons. How many tons of trash do you make each year?
- To help you visualize how much a ton weighs, add the weights of students in the class until you reach one ton. How many students does it take to make a ton? How many "students-worth" of trash do you make each year?
- How many people are in your family? If 14 pounds of trash are generated each day for every person, how many pounds or tons of trash does your family make every week, month and year?

• How many people live in Wisconsin? If 14 pounds of trash are generated each day for every person, how many pounds or tons of trash are generated each day in Wisconsin?
Discuss:
• What happens to all the trash you throw away?
• Where is "away"? Is there such a place?
• What do you think happens to waste at the landfill? (See activity: Where Has All the Garbage Gone?)
• What are possible problems with piling waste in landfills?
• What would you do with your family's trash if there was no truck that came to take it away? How might this affect the amount of trash your family makes?

4. Research the rate of human population growth in Wisconsin and the U.S. since 1650. Discuss:
• What relationship might there be between an increasing human population and the amount of trash generated?
• How might the amount of trash generated be influenced by changes in lifestyles since 1650? (See activity: How Times Have Changed.)
• How might the amount of trash generated be influenced by family income?
• How have increases in numbers of people and amounts of trash affected the environment?
• What are the predictions for future human population growth?
• What predictions might you make for the amounts of trash we'll produce in the future?
• What impacts might an increasing population have on our use of natural resources?

5. Calculate:
• If every person in Wisconsin threw away one less pound of trash per day, how much less trash would end up in our state's landfills?
Discuss:
• What could you do to *reduce* the amount of waste you make?

Pre- and Post-Activity Questions:
• How many pounds of trash do you think are thrown out each day for every person in Wisconsin?
• What relationship, if any, is there between the number of people and the amount of trash?

Going Beyond:
The 14 pounds of solid waste represent the amount you generate at home each day (4.7 lbs.) and your share of the amount generated by manufacturers and industry (9.3 lbs.) when they make products for you. Since 1990, the people of Wisconsin have been recycling more to reduce the amount of trash going to landfills. Each person recycles 1.9 pounds of household solid waste a day, and manufacturers and industry recycle 4.6 pounds a day for you (for a total of 6.5 lbs./person/day). Do some of the calculations above using 12 pounds for trash and 2 pounds for recyclables (equivalent to the 1990 recycling rate). What impact has recycling had on landfill space?

Part 2 — Class Trash

Goal: To have students calculate the amount and types of trash thrown out by their class at school and investigate where it is taken.

Subjects: Mathematics, social studies, science, environmental education, health.

Grades: 7-12

Materials:
- trash generated by your class on a typical day (save for use with Part 3)

Note to teacher:
Students will need to be familiar with the concepts of weight, volume and number in order to do the following activity and understand their implications. Consider using this activity as part of a mathematics lesson that addresses these concepts.

Procedure:
1. List the items you throw in the classroom and lunchroom wastebaskets on a typical day. Now categorize them according to what material they're made of (e.g., food, paper, plastic, aluminum, glass). Predict what four types of materials make up the greatest portion of the waste by: weight, volume and number of items. Record your predictions.

2. Collect and save the trash your class generates (in the classroom, art room, shop, lunchroom, etc.) on a typical day (wash jars and cans, place food trash in a sealed container). You can save trash for more than one day if you wish. This will enable you to calculate the average amount generated by your class each day.

3. Dump the trash on the floor. Sort items into piles according to the type of material of which the items are made.

4. Count the number of different items of each type (e.g., 47 pieces of paper, 3 aluminum soda cans, 8 juice boxes, 11 plastic bags, 1 broken pencil). What types of items comprise most of the trash by number? Draw a bar graph to illustrate this. Place the trash by type in separate bags.

5. Select the four types of items you estimate make up most of the trash by weight. Use one of the following methods to determine the exact or approximate weight of each type:

a) If you have a grocery scale in your classroom, weigh the items.

b) If you have a bathroom scale:

example

- Stand on the scale.
  What is your weight? ..... 100 lbs.
- Pick up a bag.
  Now what is your weight? ..... 102 lbs.
- How much does the bag weigh? ..... 2 lbs.

c. If you don't have a scale, find objects in the classroom that are of a known weight. Compare the weights of your object and the trash (use a balance if you have one). Estimate the weight of the trash.

6. Calculate the volume of the trash in each bag by measuring the width, length and depth of items in it. How might volume differ if the glass, cans or boxes are crushed? Does weight change if volume changes?

7. How do your calculations compare with the predictions you made in step 1?

8. How much trash does your class throw out in a day, week, month and school year by weight, volume and number? Calculate the average amount each student throws out in one day.

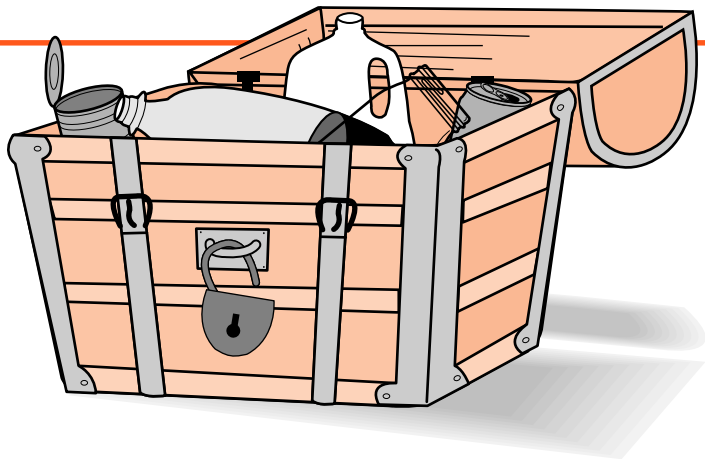
9. How much space will one school year's-worth of your class's garbage fill if the garbage is not compressed? Calculate the volume of your classroom. If you didn't remove any of your class's trash from the classroom, how much of the room would be filled with trash by the end of the year? How much room would be left for you?

10. If the number of students in your class is average for your school, calculate how much trash your school generates each school year. Discuss:
- Do you think your class makes a lot of trash? Not so much? Explain reasons for your response.
- When the trash from each class in the school is added together, do you end up with a lot of trash? Explain reasons for your response.

11. Investigate where your school's trash is taken. (See activity: Where Has All the Garbage Gone?)

Pre- and Post-Activity Questions:
- How much trash do you think your class throws away each day?
- What types of trash do you think your class throws away on a typical day?
- What happens to your school's trash?

Part 3 — Trash or Treasure?



Goal: To have students find out why, how and where they should recycle or reuse what they typically throw away.

Subjects: Science, social studies, language arts, environmental education, consumer education, family living, marketing.

Grades: 4-12

Procedure:
1. Is there anything else you can do with what you throw away? List your ideas. Most of them will fit into one of the following five categories: reduce, reuse, recycle, compost, recover energy. Write these five categories on the board. What trash items might fit best into each category? List them under the proper category heading.

2. Do a) and/or b), then answer the discussion questions:
a) To the teacher: Give each student a copy of the following checklist to fill out, or put the list on the board and work through it as a group. For younger students, you may want to use pictures of the items listed below. Feel free to add your own items.

Directions:

Put an X next to items you threw in the wastebasket this week.

____Paper bag

____Napkin

____Newspaper

____Book

____Magazine

____Paper milk carton

____Other paper

____Gum wrapper

____Aluminum can

____Apple core

____Orange peel

____Grass clippings

____Old clothes

____Plastic bag

____Plastic milk carton

____Broken toy

____Tin can

____Glass jar

____Other

Now circle all the items you think could have been reduced (used less of), reused or recycled.

Discuss:
• What items did you circle?
• How could you have reduced items?
• How could you have reused items?
• Did you wonder whether the napkin was paper or cloth? What difference might it make?
• What could you have done with the recyclable items?
• What could you have done with apple cores and potato peels?
• Which items are difficult to reduce, reuse or recycle? Why?
• Why do we make products that aren't reusable or recyclable?
• Did any of your classmates reduce, reuse or recycle any of the items you circled?
• How did they reduce, reuse or recycle the items?
• Was reducing, reusing or recycling them easy to do? Why or why not?
• What do you think happens to the items you didn't circle?

b) Sort the items that your class threw out in one day (Part 2) into the following categories: reusable, recyclable and other. Discuss:
• Why did you place each item in the category you chose?
• Does your class recycle any of the items?
• Should your class recycle them? Why?
• Are there some items your class could recycle but doesn't? Why doesn't your class recycle them?
• Are there places in school aside from the classroom where you discard trash during the day? Think about how much food and how many food wrappers, cans and bottles you discard at lunch, how many paper towels you use to dry your hands, etc.
• What happens to the items that aren't reusable or recyclable?

3. Investigate where in your community you can take items to be reused or recycled.
• How can you find out about local recycling programs? (Contact: local natural resources and environmental protection agencies, glass manufacturers, recycling businesses, municipal public works departments, used furniture and clothing stores and environmental organizations.)
• Make a list with the following information about the businesses or organizations that recycle: name, address, telephone number, materials recycled, hours of operation, whether the organization will pay you for materials and any other useful information. This information is available in: Wisconsin Markets Directory (see Resources).

4. Investigate and discuss:
• What are some advantages of recycling? (Conserves natural resources, saves energy, protects the environment, can make money, creates jobs for people involved in recycling and reduces our dependence on imported materials.)
• What are some disadvantages of recycling? (May cost money, takes time, takes space for storage, takes away jobs from people who make products from nonrecycled materials and depends on recycling markets.) (See activity: The Cost of the Toss.)
• What are the pros and cons of energy recovery and landfilling?

5. Brainstorm the steps your class might take to design and implement a recycling project for your classroom or school. (See activity: Time for Action.) Select a project that is feasible. For example, collect and recycle paper from the school's copy machine and classrooms. Who can you contact to help you with your project?

6. Consider doing your project!

Pre- and Post-Activity Questions:
• What is recycling? What are reuse, energy recovery and landfilling?
• What types of solid waste can be recycled, reused, recovered or landfilled?
• What can you do in your school to recycle solid waste?

Part 4 — Cutting Class Trash

Goal: To have students realize that reuse and recycling of materials are not the only or main solutions to the solid waste problem. A key step is to cut down on the use of materials that become solid waste.

Subjects: Consumer education, family living, social studies, science, environmental education.

Grades: 5-12

Procedure:
1. In what ways can you reduce the amount of trash you throw out at school? Don't forget to consider waste from the art room, shop, lunchroom, etc. Write your ideas on the blackboard and request that it not be erased for one week.

2. For one week, cut down on your use of paper, food packaging and other materials. Refer to the suggestions on the blackboard. Note: It isn't fair to "cut down" by throwing things out in other trash cans in the school.

3. At the end of each day, calculate the amount of trash and list what individual items make up most of the trash. (See Part 2 for instructions.)

4. Compare your findings with the amounts calculated in Part 2. Calculate:
- Did you throw out less trash when you tried to cut down? How much less?
- If your class cut down on use of materials for the school year, how much less trash (in pounds) would you send to the landfill?

Discuss:
- How easy is it to cut down on how much you use?
- Do you feel that it is worth doing? Why?
- Will you continue to cut down on your use of materials, or is this class activity a one-shot deal?

Pre- and Post-Activity Questions:
- How can you reduce the amount of trash you generate in your class/ school each day?

Going Beyond:
1. Take a copy of the checklist and questions from Part 3 home and fill it out. Note to teacher: Include a cover letter to parents explaining that the class is studying solid waste and recycling, and you would like them to help their children see what kind of solid waste is generated at home. Discuss:
- What did you find out about what your family throws away?
- How do you feel about your findings?
- What ideas do you have for what you could do with the trash generated at home?

2. Trace the "afterlife" of one of the items on the checklist from Part 3. For example, what happens to the plastic bag or paper milk carton after it's taken to the landfill? Does it decompose? Does its decomposition create harmful by-products? What impacts might its decomposition have on air, soil, water and health?

3. Create a reusable item from something you're going to throw away.

4. Investigate what types of used materials organizations like the Salvation Army and Goodwill Industries need and what they do with the materials they receive. Look for stores in your community that sell used products (appliances, furniture, sports equipment, etc.) Look for businesses in your community that repair items.

5. Discuss the role of yard sales or garage sales in recycling and reusing materials.

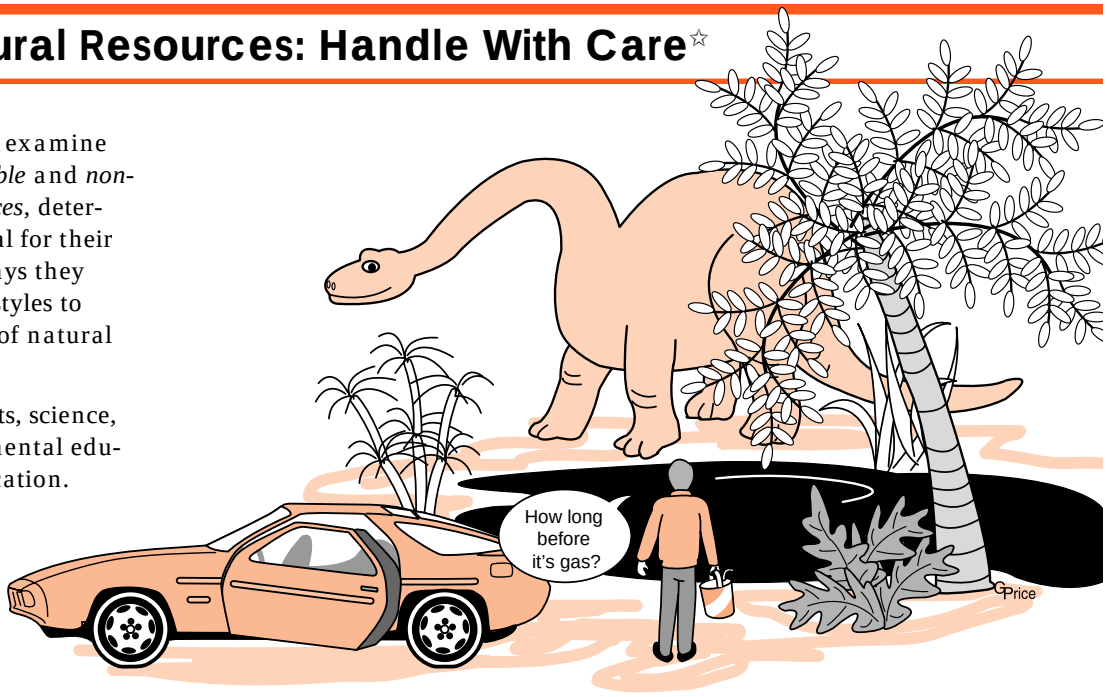
6. Investigate how the amounts and types of wastes generated by a bank, office building, grocery store, clothing store and hospital differ. How does each business dispose of its waste? Do any recycle materials?

7. Our changing lifestyles over the last 20 years have affected what and how much we throw away. What lifestyle changes have affected our disposal habits?

8. Research and report on waste disposal habits of other countries. How do they deal with solid waste? Do they make as much garbage as Americans do? Why or why not? How do you feel about this?

Right in My Hometown

Part 1 — Natural Resources: Handle With Care☆



Goal: To have students examine their own use of *renewable* and *nonrenewable natural resources*, determine which are essential for their survival and suggest ways they might change their lifestyles to make more careful use of natural resources.

Subjects: Language arts, science, social studies, environmental education, technology education.

Grades: 6-12.

Procedure:
1. What is a natural resource? List several examples.

2. Define the terms "renewable" and "nonrenewable" resource. Some renewable resources are: solar energy, water, food and wood. Some nonrenewable resources are: petroleum, tin, bauxite, coal, copper and lead.

3. Do a, b or c below:

a) List the products you used or consumed during a specific time period, e.g., between the time you got home from school yesterday and the time you went to bed; between the time you got up this morning and the time you left for school.
b) Describe a scenario or event, and as a group, list what products were used.
c) Have the teacher select and read a story in which people use a variety of products. As a class, list what products were used. Discuss:
• Which products are made of renewable resources, nonrenewable resources?

4. Classify each product as: essential to survival, necessary for maintaining my present lifestyle, a luxury. Discuss:
• What criteria did you use to define what is essential, is necessary for maintaining your present lifestyle or is a luxury?
• Which, if any, items listed in the "essential" category are really not essential for survival? Explain your response.
• Do you think your parents or grandparents would place the products in different categories? How would their list differ from yours?

5. After discussing the lists, suggest alternatives for each item, making an effort to replace items you think are inefficient or wasteful with items that are less wasteful. Discuss:
• Would using alternatives increase or decrease your use of renewable resources?
• Would using alternatives increase or decrease your use of nonrenewable resources?
• How might changes in the production and consumption of these products influence the economy and the environment?
• Why do we use nonrenewable resources to make products?

6. Look at the list of luxury items. Which items could you give up without a major change in your lifestyle?

7. Make a list, beginning with the easiest item to give up and ending with the most difficult. Could you give up the top three items on this list for a day? a week? a month? Try it. How do you feel?

8. Think of several ways to reuse or recycle items you decide you can't give up.

9. Identify some of the economic, cultural and environmental impacts of any changes you make or recommend. Consider the implications if your entire family, school, community and country made such changes.

Pre- and Post-Activity Questions:
• Define and give examples of: natural resource, renewable resource, nonrenewable resource.
• List four items you use that aren't essential for your survival. What impact does their production or disposal have on our environment, economy, culture?
• Would you be willing to give them up or use alternatives if you discovered that the impact is significantly adverse?

Part 2 — Biography of a Product

Goal: To have students investigate the natural resources required to make a product that is manufactured in their community, determine whether the resources are renewable or nonrenewable and consider the impacts that production has on the environment and economy (locally and elsewhere).

Subjects: Social studies, science, health, language arts, environmental education.

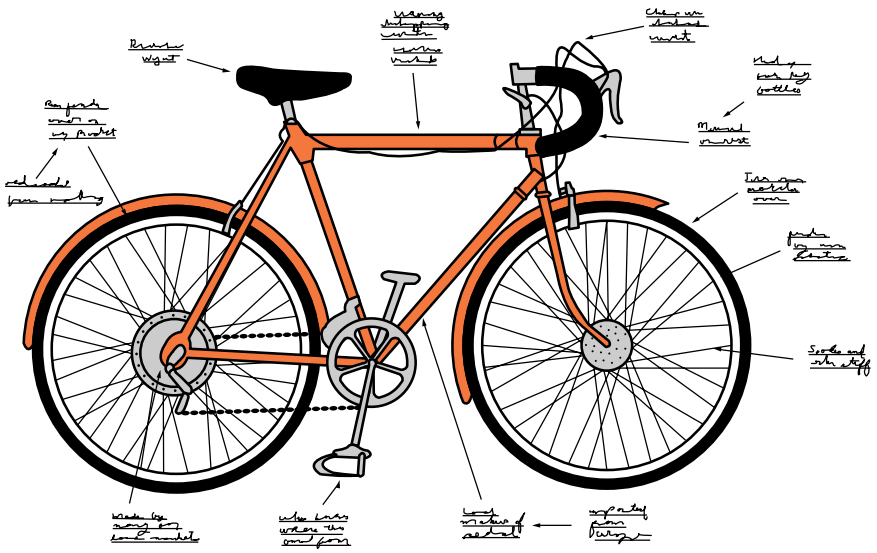
Grades: 6-12

Procedure:
1. Select one product that is made in your community. For example, bicycles are made in Waterloo, batteries and bologna in Madison, pens in Janesville, soy sauce in Walworth, shoes in LaCrosse, ships in Sturgeon Bay, beer in Milwaukee, glass in Burlington and cheese, paper and plastics in many towns.

2. List or draw on the blackboard the production steps and all the *raw materials* required to make the product. Contact or visit the manufacturer if you need more information about the process and materials used to make the product.
Discuss:
• Are more raw materials required to make your product than you expected?
• Where did the raw materials come from? Is the source in your town, state or country?
• What amounts of these raw materials are available?
• What happens to the environment when the raw materials are extracted from the earth or harvested? Does this process produce pollutants or destroy land or ecosystems? How might it affect people living in the area?
• Were the raw materials changed (refined) before they got to your town?
• Were there any by-products made from refining the raw materials?
• What happened to these by-products?
• What impacts does each step in the manufacturing process have on the environment? the economy?

3. Categorize the product as: essential to survival, necessary for maintaining my present lifestyle or a luxury. Discuss:
• What criteria did you use to make your decision?
• What impacts does use of the product have on the environment?

4. Describe what happens to the product after you use it. Discuss:
• Can it be used up or will it wear out?



• What will you do with it?
• Can the product or its parts be reused or recycled in some way? How?
• Will the product or its parts decompose if buried in a landfill?
• What effects does disposing of this product have on the environment?
• Can it be safely burned to produce energy? Does burning it release harmful chemicals?
• Who pays for disposing of the product?
• Who is responsible for disposing of it?

Going Beyond:
Investigate answers to the following questions by checking books, articles and magazines, or writing to agencies or organizations for information.
• What natural resources used by the U.S. come from other countries? How much of each resource is imported? found in the U.S.?
• How does importing raw materials influence: U.S. and world economics, politics and security; the local and global environment; social systems and jobs in the U.S. and other countries?
• What used, recyclable materials (e.g., newspaper, scrap metal) does the U.S. export to other countries? Why does the U.S. export these materials? Why do the other countries import these materials?
• How long will known reserves of coal, wood, oil, iron, copper, petroleum, water, bauxite, natural gas and zinc last if we continue to use them at present rates? Are any of them renewable resources? What might happen as we begin to use up these resources? (Investigate: offshore oil development; mineral exploration in Antarctica and world political implications; the coal economy of Kentucky and West Virginia; U.S. oil interests in the Middle East; timber controversy in the Pacific northwest.)

Where Has All The Garbage Gone?

Part 1 — Making a Mini-Landfill☆

Goal: To have students examine the materials that comprise the products they use, describe whether these materials are renewable or nonrenewable resources, observe what happens to materials when placed in an old fashion dump and a newer sanitary landfill and decide whether they should be disposed of in a different way.

Subjects: Science, social studies, environmental education.

Grades: 4-6.

Materials:
- eight large clear glass jars
- four tight-fitting lids for jars
- dry soil
- miscellaneous solid waste
- crayons
- masking tape

Procedure:
A) 1. Choose one item you threw away today. What is your item made of? Into which of the following four categories of solid waste does your item fit?
a) organic (e.g., potato peels)
b) renewable resource/recyclable (e.g., newspaper)
c) nonrenewable resource/recyclable (e.g., aluminum cans)
d) nonrenewable resource/hard to recycle (e.g., tooth brush)

2. What happens to the item you threw away? Discuss:
- Where is away?
- What is a dump?
- What is a landfill?
- What is the difference between a dump and a landfill?

3. List ways you can avoid disposing of your item in a landfill.

B) 1. With crayons and masking tape, label two sets of glass jars with the four category headings above. Label one set of jars "Set 1"; the other "Set 2".

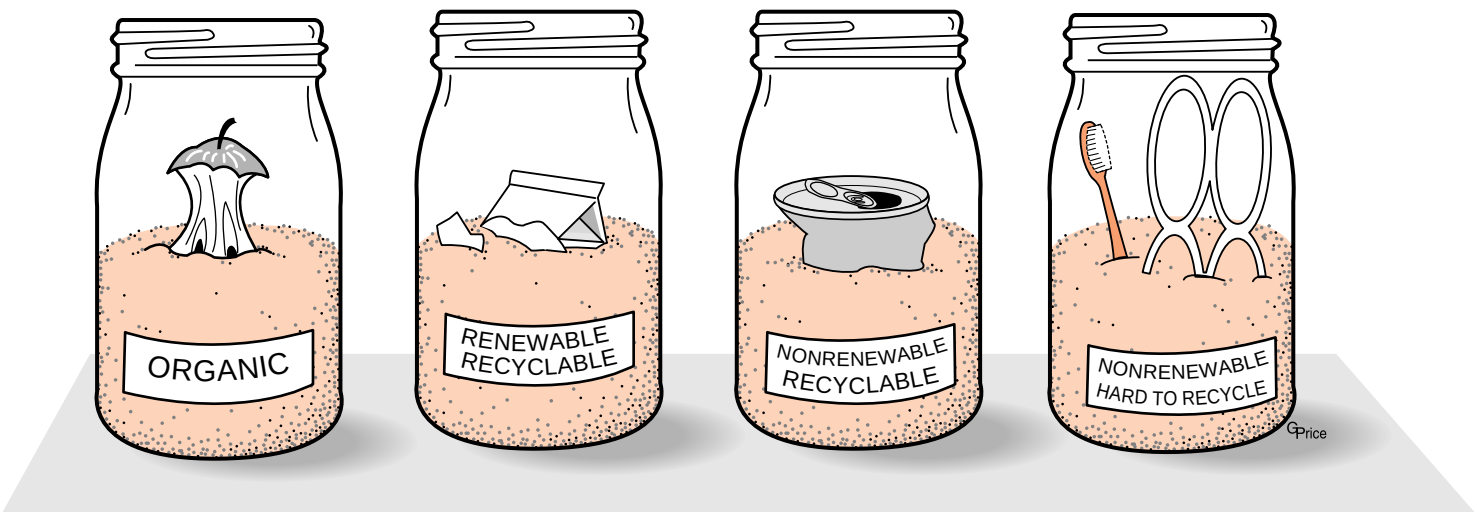
2. Fill each jar in "Set 1" and "Set 2" about half full with soil.

3. Sort each solid waste item into its proper category (a-d). Put a small sample of each into the "Set 1" and "Set 2" jars with the corresponding labels and cover with soil. Do the following:
- "Set 1", leave the lids off and keep soil damp with water.
- "Set 2", put the lids on tight; do not add water.
- Place both sets of jars on a shelf away from people and out of direct sun.

4. Predict what you think will happen to the solid waste in each jar. Record your predictions.

5. Observe and record what changes occur during a 4-6 week period, if any. Discuss:
- What happened to the items made of organic and renewable resources in "Set 1"? "Set 2"?
- What happened to the items made of nonrenewable resources in "Set 1"? "Set 2"?
- How did what happened compare with your predictions?
- What comparisons can you make between "Set 1" and "Set 2".

6. "Set 1" represents the old fashioned dump; "Set 2" represents the newer sanitary landfill. What comparisons can you make between your mini-dumps and mini-landfills and a real dump and a real landfill?



C) 1. Keep a record of your family's purchases from two trips to the grocery store. Divide the items into the four solid waste categories listed above. Discuss:
• What does your family do with the waste from its store purchases?
• Is there anything your family could do with the waste from its store purchases besides landfilling?
• Could you substitute items from "d" with items from "a-c"? Is this a worthy goal? Why?
• If your goal is to reduce solid waste, what else could you do with items from "d" to keep them out of landfills?

Pre- and Post-Activity Questions:
• Define and give examples of: organic material, renewable resource, nonrenewable resource.
• What do you think will happen to items made of renewable or nonrenewable resources when they're put in modern landfill?
• List four items you use everyday that you could recycle.

Part 2 — Follow That Garbage!

Goal: To have students see where their garbage goes and investigate their community's solid waste disposal issues.

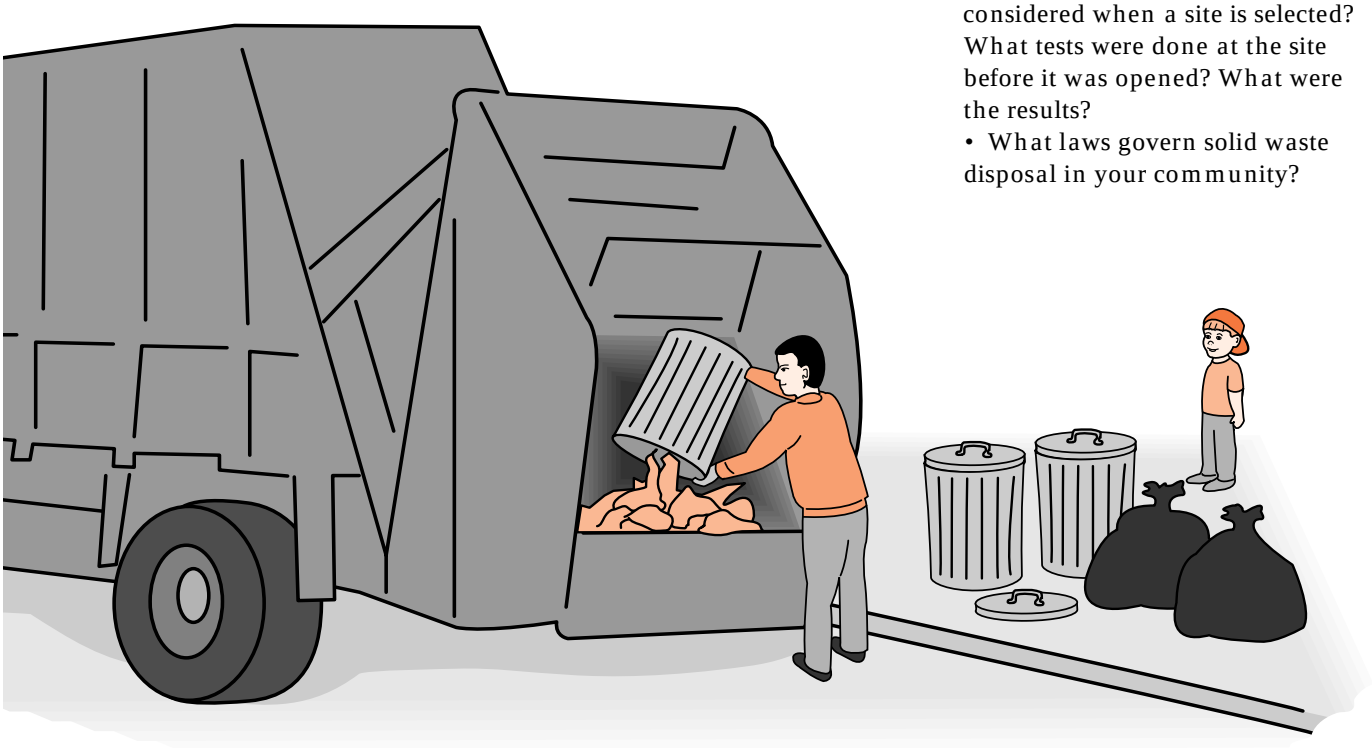
Subjects: Social studies, science, health, environmental education.

Grades: 4-12

Procedure:
1. a) Contact your municipal landfill and obtain permission for your class to visit it. Arrange for the site manager, owner or other resource person to guide your trip and be available to answer questions. A list of local waste disposal sites can be obtained by contacting your DNR district solid waste management specialist. Be sure to follow all safety precautions while visiting the site.

b) If you are unable to take a field trip, ask a guest speaker to come and discuss local solid waste management with your class. Resource people you might contact are: waste disposal site operators, private waste haulers, Extension agents, environmental health officers, government officials, environmental organization representatives, DNR and local solid waste managers and public works personnel.

2. Before visiting the municipal landfill or having a guest speaker, develop a list of questions you would like answered. Investigate possible answers to your questions. Then send the questions to the guide or guest speaker in advance so he/she can prepare responses. Questions to consider include:
• Where is the trash from your school or home taken?
• How does it get there?
• Why was the landfill located on this site? What factors must be considered when a site is selected? What tests were done at the site before it was opened? What were the results?
• What laws govern solid waste disposal in your community?

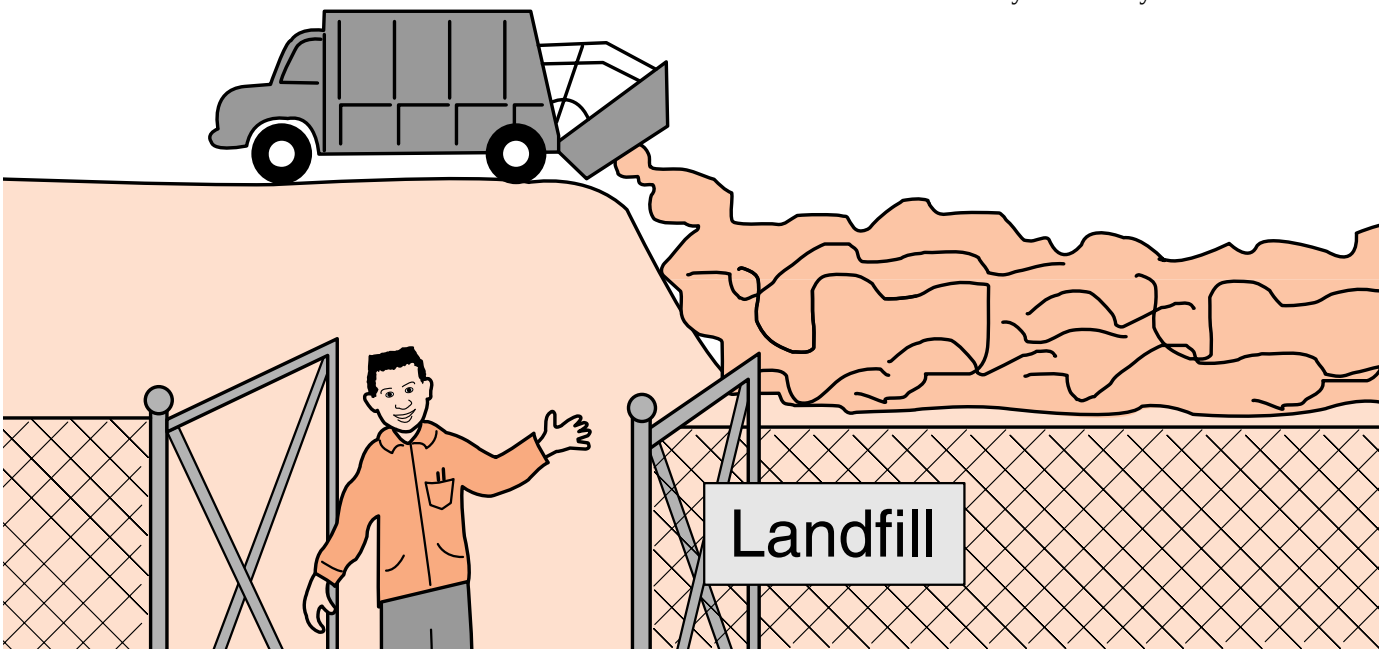


• Is the landfill an engineered or unengineered site?
• Who owns the landfill? When did it open? What was the cost of constructing it?
• Who does the site serve? Who can bring wastes to the landfill?
• What is the fee for using the landfill?
• How much does your family pay for trash collection?
• How much does it cost to take care of trash once it's in the landfill?
• How much solid waste is disposed of at this site daily, weekly and yearly?
• Who works at the site? Do they monitor what is dumped?
• What happens to the trash once it is dumped in the landfill?
• Are any of the materials hazardous? Are there regulations or procedures for dealing with hazardous wastes?
• What is the land adjacent to the landfill used for? Is the landfill a problem for nearby landowners? If so, in what ways? What has been done to alleviate the problems?
• How is the site managed for control of blowing trash, odors, noise, animals, erosion, surface runoff, leachate and methane gas?
• Are tests performed regularly at the site (groundwater, soil, methane gas)? What are the results?
• Is there a resource recovery program at the site? If so, what is recovered? How?
• What impacts does resource recovery have on the economy and environment?
• How many years is the landfill expected to last? How much time does community have to find a new site?
• How will the landfill be monitored and cared for after it is closed? Who is responsible? Who pays for this? What will be done with the land at the site?
• What alternatives for waste disposal is your community practicing or considering for the future?
• How have or will these alternatives impact the amount of trash going to the landfill?
• How can you participate in making the decisions that develop future waste management plans in your community?

3. Now that you know more about landfills:
• How do you feel about them? Will we always need them?
• Are they the best way to dispose of trash? What are possible alternatives?
• What can you do to help reduce solid waste?

Pre- and Post-Activity Questions:
• Where is the trash you throw away taken?
• What eventually happens to your trash there?
• What is the difference between a *dump* and a *sanitary landfill*?

Going Beyond: For older students...
• If your community has a solid waste incinerator, visit it. What are the pros and cons of incineration?
• Investigate waste disposal techniques, problems and laws in other parts of Wisconsin, other states in the U.S. and the world. Consult individuals, books, newspapers, magazines and state agencies.
• Conduct a hearing to decide where to locate a landfill in your community. Take the roles of the people involved with the decision: local landowners, politicians, industry representatives, environmentalists, waste managers and others.
• Landfills often have been developed in wetlands, although this is now illegal in Wisconsin. Consider the following questions:
• Why were landfills often located in wetlands?
• What problems might exist with placing landfills in wetlands?
• Are wetlands an important ecosystem? Why?



Composting: A Great, Rotten Idea

Background: When we mention "recycling," we often think of recycling glass bottles, aluminum cans and newspapers. Another 22% of the household garbage we throw out can also be recycled. These recyclables are food scraps, leaves, grass clippings and other *biodegradable* organic wastes. Organic wastes can be recycled by *composting*. Simply stated, composting involves creating conditions to promote decomposition. Decomposition is the biochemical process by which bacteria, fungi and other microscopic organisms break organic "wastes" into nutrients that can be used by plants and animals. Decomposition occurs in nature whenever a leaf falls to the ground or an animal dies. It is essential for the continuation of life on earth. The result of decomposition in a compost pile is a nutrient-rich mulch that is excellent for improving soil quality and plant growth.

Part 1 — Is It Rotten?

Goal: To have students investigate the pros and cons of composting.

Subjects: Science, health, environmental education, vocational agriculture, consumer education, family living.

Grades: 4-12

Materials:
- rotting log, grass clippings, leaves or food scraps

Procedure:

1. Define: recyclable, biodegradable. List materials that are recyclable and/or biodegradable.
- Are there recyclable materials that aren't biodegradable? Are there biodegradable materials that aren't recyclable?

2. Feel, smell and look at the rotting log, grass clippings, leaves or food scraps. What words would you use to describe these materials? List these words. Do the words have positive and/or negative connotations? Why?

3. Explain what is happening to the rotting material. Discuss:
- What is the natural process that breaks biodegradable material into particles that can be used again by plants and animals? (decomposition)
- What organisms assist in this decomposition process? (fungi, bacteria, earthworms, springtails, mites, etc.)
- What will your rotting material finally become? (humus)

4. Imagine a world where decomposition doesn't take place. Discuss:

• What would happen to organic materials like dead animals, leaves or sewage?
• Could plants and animals survive if decomposition did not occur? Why or why not?
• Is decomposition important? Why?

5. Now think of words to describe rot or decomposition. List them. Do the words have positive and/or negative connotations? Why?

6. List items you throw away that are biodegradable. Discuss:
• How might you and your family recycle these materials?
• What is composting?
• Why do you think people compost household organic wastes?

7. What are some benefits of composting household food and yard wastes? For example:
• Doesn't require the purchase of plastic bags often used for disposing of household and yard wastes.
• Saves the cost of transporting wastes to and handling wastes at the landfill. Wisconsin discards 3/4 million tons of compostable municipal yard waste and food scraps every year. It costs $80-93 per ton to collect wastes in urban areas and $25-$32 per ton to dispose of them. How much money do Wisconsin citizens spend each year disposing of their compostable wastes?
• Saves space in the landfill. Landfills are filling up fast. At the end of 1990, Wisconsin had 38 million tons of municipal landfill capacity left and was filling up landfills at the rate of 4.6 million tons per year. Within 8 years, most will be filled to capacity. Thus, Wisconsin already has a serious problem — where will we put all our waste?
• Reduces pollution from landfills.
• Creates nutrient-rich mulch you can use to fertilize and improve the texture of your yard and garden soil; saves money you might spend on mulch or fertilizer.

8. What are some possible problems with composting? Are they really problems? Here are some potential problems and answers:
• It's too much work. Once you have established your composting site, composting takes very little time and effort. If you make it into a routine, composting is easy. If you want to do less work, leave your grass clippings on the lawn and plant low-maintenance lawn covers. Follow the guidelines in Yard Care: Do Your Share (see Resources).
• You'd have to run outside every time you eat an apple or peel a potato. Just place scraps into a plastic container with a lid. Keep the container in or under the kitchen sink, then take the waste to the compost pile whenever the container is full.
• Yard wastes and food scraps can be thrown away because they are not harmful to the environment. Landfilled yard wastes and food scraps take up space and may release harmful methane gas. Food scraps put down the garbage disposal end up in the sewage system, where treating them can tax the system and cost money. If you can afford a garbage disposal, perhaps you can afford a "no work" composter. Easy-to-use, compact and attractive composting bins are available commercially. Contact your garden center or the DNR Bureau of Solid and Hazardous Waste Management for details.
• It might smell and attract rats. If you maintain your compost pile according to basic guidelines in publications like Home Composting: Reap a Heap of Benefits and Home Composting: The Complete Composter (see Resources), your pile should not smell or attract rats.
• The neighbors might not like it. If you locate, build and maintain your pile properly, it should not be offensive. Take the opportunity to explain what you are doing to your neighbors and why you feel composting is important.

Part 2 — Readin', Rottin' and 'Rithmetic: Classroom Composting

Goal: To have students learn about recycling in nature and actually recycle organic matter by composting.

Subjects: Science, health, environmental education, consumer education, family living, vocational agriculture.

Grades: 4-12.

Materials:
- fish aquarium
- organic waste materials (be sure to add a variety of materials, not all one kind, i.e., use sawdust, hair, wood ash and leaves in addition to food scraps; avoid meat scraps, fats and oils, which inhibit decomposition and in outdoor compost piles can attract dogs, rats, raccoons and other animals)
- lawn fertilizer that contains nitrogen (but not herbicides or insecticides) or manure and green grass clippings that also contain large amounts of nitrogen. Be careful, don't use too much nitrogen, a carbon: nitrogen ratio of 25-30:1 is ideal. (Grass clippings already have a carbon:nitrogen ratio of 19:1 while leaves have a 60:1 ratio.)
- soil
- 1-2 dozen red earthworms (obtain from yard, garden, school grounds, or local bait shop)
- thermometer
- trowel or large kitchen spoon (for turning, or aerating, the pile)

Note: Air circulation is important to decomposition, thus the best compost bin is one with wire or screen sides. Mass also is important, since approximately one cubic yard of compost is needed to generate good decomposition temperatures (104-170 F). Thus, an aquarium, with its small size and glass sides, is not the best compost container. Consider constructing an outdoor compost pile with wire sides on the school grounds. For instructions on outdoor composting, contact: DNR Bureau of Solid and Hazardous Waste Management.

Procedure:
1. What "ingredients" do you think are needed to construct a compost pile? Why? List ingredients. For example:

• soil: contains microorganisms that help decomposition.

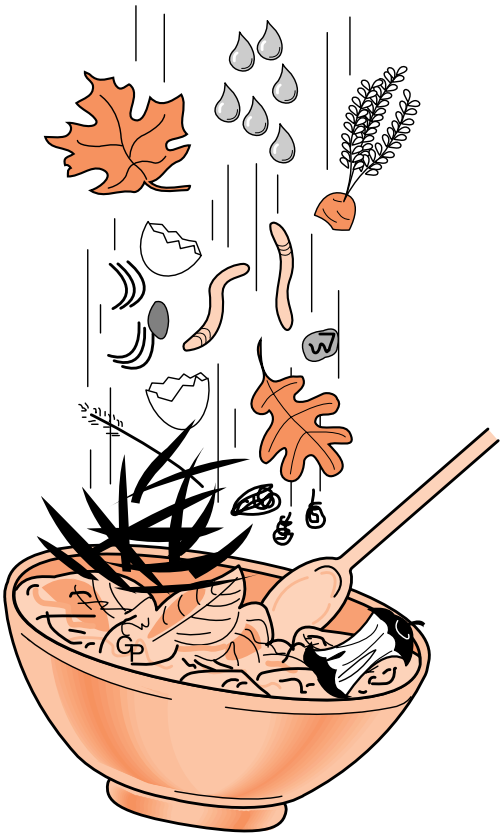
• organic wastes: such as leaves, food scraps, grass clippings. Wastes should be varied, including materials with both carbon and nitrogen. By alternating layers of high-carbon and high-nitrogen materials, you can create good environmental conditions for decomposition to occur.

• nitrogen: many of the organisms responsible for decomposition need nitrogen, thus nitrogen is necessary for rapid and thorough decomposition. Nitrogen is found naturally in organic wastes (higher in "green" materials like grass clippings than in "brown" materials like dry leaves), and in many commercial fertilizers.

• worms: they eat the waste, helping to break it down; make droppings, which enrich the soil; tunnel through and aerate the waste, facilitating decomposition; and eventually die and become part of the compost.

• water: necessary for normal functioning of life. Too much water in a compost pile may make it soggy and slow decomposition by reducing needed oxygen.

• air: the biological activity of fungi, bacteria, small insects and other organisms results in decomposition. Most biological processes require adequate amounts of oxygen.



• time: decomposition takes time. To speed up decomposition, aerate (by turning it over) your pile every few days; otherwise, just leave it and wait.

• heat: heat is produced by chemical reactions resulting from increased biological activity that occurs during decomposition. Heat helps sanitize compost by killing certain organisms (e.g., weed seeds, pathogens, harmful insect larvae).

• mass: in order to generate enough heat for optimal decomposition, the pile must contain at least one cubic meter of organic material. Thus, the temperatures generated in an aquarium compost pile may be different from those generated in one that is larger.

2. Design a plan for making a mini-compost pile in the classroom. Decide which ingredients students

will provide and which will be supplied by the teacher. Set a date for constructing your pile.

3. Suggestions for creating a mini-compost pile:
a) Chop the organic wastes into small pieces. You can leave some large pieces of the same materials to compare rates of decomposition between large and small items. Why might there be a difference?
b) Alternate layers of the materials as follows (amounts are approximate): inch of soil, two inches of organic waste, sprinkle of fertilizer, sprinkle of water, repeat.
c) Cover with an inch of soil. Water the pile enough to make it moist but not soggy. It should feel like a damp sponge (it feels moist, but you can't squeeze water out of it).
d) Add the earthworms and observe their behavior.
e) Place your compost pile where it will be at room temperature (not in direct sun).

4. Place the thermometer in the middle of the pile. Wait an hour or so, then record the temperature.

5. Record the temperature from the same location and depth, and at the same time each day. Why is it a good idea to be consistent with location, depth and time of recording? Does the temperature change? Why or why not? Make a graph to show your temperature results.

6. Gently mix the compost once a week to aerate it. A good time to turn the compost is after the temperature peaks and begins to drop. Why? Be sure to record the temperature before you turn the compost that day.

7. Be patient. Occasionally check the moisture and add water if needed.

8. Make a chart to help you keep a daily record of temperature and other observations during the next month or two. Observe:
• Which materials break down the fastest? Slowest? Why?
• Are there any odors? Why do you think decomposition has an odor?
• Does the texture of the compost change? In what ways?

9. Once the materials in your compost pile have decomposed into humus, conduct the same feel, smell and look test that you did in Part 1, #2.

10. Now decide what your class should do with this rich soil. When you clean out the aquarium, should you dump the humus in the trash; take it outside and dig it into the soil; or use it for growing plants in the classroom?

11. Discuss:
• How does composting reduce the amount of waste you would have thrown out?
• What do you think happens to organic wastes that end up in the landfill?
• Is the landfill a gigantic natural compost pile, or are there problems with placing large amounts of organic material in landfills? (no air, limited moisture, etc.)

12. Now that you have constructed and maintained a mini-compost pile in the classroom, how would you go about constructing and maintaining one at home?

Pre- and Post-Activity Questions:
• What is composting?
• What are the necessary "ingredients" for a good compost pile?
• How is composting related to the concept of recycling?
• How can composting reduce waste?

Going Beyond:
• Create a compost pile as in Part 2, but also add manufactured items like a soda can, paper clip, bottle cap, aluminum foil, iron nail, pencil, crayon, paper, plastic bag, rubber band, etc. Predict rates of decomposition or lack of decomposition and observe actual changes, if any.
• Take a field trip to a local woods or park. Examine a rotting log or leaf litter. Place a sample of rotting humus in a white enamel pan and sort through it carefully, looking closely for "decomposers." What decomposers (insects, mites, fungi, etc.) can you find? What do you think they are doing? Read about their life histories.
• Make a Berlese funnel to help you capture tiny soil animals. Examine them using a magnifying glass or binocular microscope. Make drawings of them and try to figure out what kind of animal they are. Read about their life histories.
• Make a worm composter. (see Worms Eat My Garbage in Resources.)
• Visit someone who maintains a compost pile. Why do they compost? What do they do with the compost? Have they had any problems? Would they recommend composting?
• Investigate what happens to the leaves your community discards each autumn. What do you think should be done with them?
• If your community has a municipal composting center, take a field trip to it. Be sure to prepare questions to ask the guide.
• Have students design experimental compost piles. For example, make a pile that: is low in nitrogen; lacks moisture; has little air circulation; or is made of a single ingredient (e.g., just grass clippings). Also create a good compost pile for comparison. Compare rates and temperatures of decomposition between piles.
• Fill flower pots with different soil types, including one type that has your humus mixed in. Plant seeds or grow seedlings in the pots. Make 4-5 pots with each soil type so that you're comparing more than one plant grown in each type (i.e., so that you have a large enough sample size to make a valid judgement). Do the plants in different soil types grow at different rates, with different vigor, color, etc? What are possible explanations for any differences?

Is It A Waste?

Background: Why do we buy one product instead of another? Often it's because of the packaging. Packaging accounts for over 30% of all consumer wastes. While packaging is designed to protect merchandise, it also is designed to sell products. Excess and non-recyclable packaging add to our energy and waste problems. The packaging industry has been responding to the solid waste problem. One of their solutions is "light-weighting" or reducing the amount of material used to make a package. Consumers can help too.

Part 1 — All Wrapped Up☆

Goal: To have students investigate the purpose of packaging and identify ways to reduce the amount of packaging they throw away.

Subjects: Family living, consumer education, social studies, language arts, health, science, environmental education.

Grades: 4-12

Procedure:
1. Bring in an example of food packaging. Discuss:
• Why is the product packaged? (To protect the product, hold product during shipping, prevent spoilage, protect health, prevent theft, provide convenience, make the product look more appealing, etc.)
• Is the packaging essential? wasteful? Why or why not? What criteria are you using to make your decision?
• What influence do you think packaging has on the salability of the product?
• Does the packaging benefit your lifestyle?
• How does the packaging affect the quality of the product?

2. Design a way to categorize the packaging. For example, sort it according to "natural" packaging (bananas, apples, peanuts); "older" packaging (paper bags, returnable glass bottles); and "modern" packaging (plastic wrap, polystyrene, plastic milk bottles). Discuss:
• What happens to the packaging once the product is used?
• Which packaging is/isn't recyclable?
• Which packaging is/isn't made from recycled materials? renewable resources?
• What are the environmental pros and cons of making and disposing of each type of packaging?
• Which packaging would you label "most wasteful?" "least wasteful?" Why?
• If this packaging didn't exist, how would your lifestyle be affected?

3. Brainstorm ways that you could reduce the amount of packaging you purchase. For example, could you purchase products in bulk? How would this help reduce packaging? (A 3 ounce tube of toothpaste requires 50% more packaging per ounce than a 7 ounce tube.) What problems could develop as a result of your choice? (Some food bought in bulk might spoil before you eat all of it.)

Pre- and Post-Activity Questions:
• List three examples each of recyclable and non-recyclable packaging.
• What criteria might you consider when deciding whether packaging is necessary? wasteful?
• What happens to most of the packaging you purchase? What can you do to change this?

Part 2 — What's the Appeal?☆

Goal: To have students quantify the number of times television and radio ads try to sell products for reasons not related to product quality and list some of the techniques advertisers use to promote products.

Subjects: Social studies, language arts, consumer education, family living, environmental education.

Grades: 7-12

Procedure:

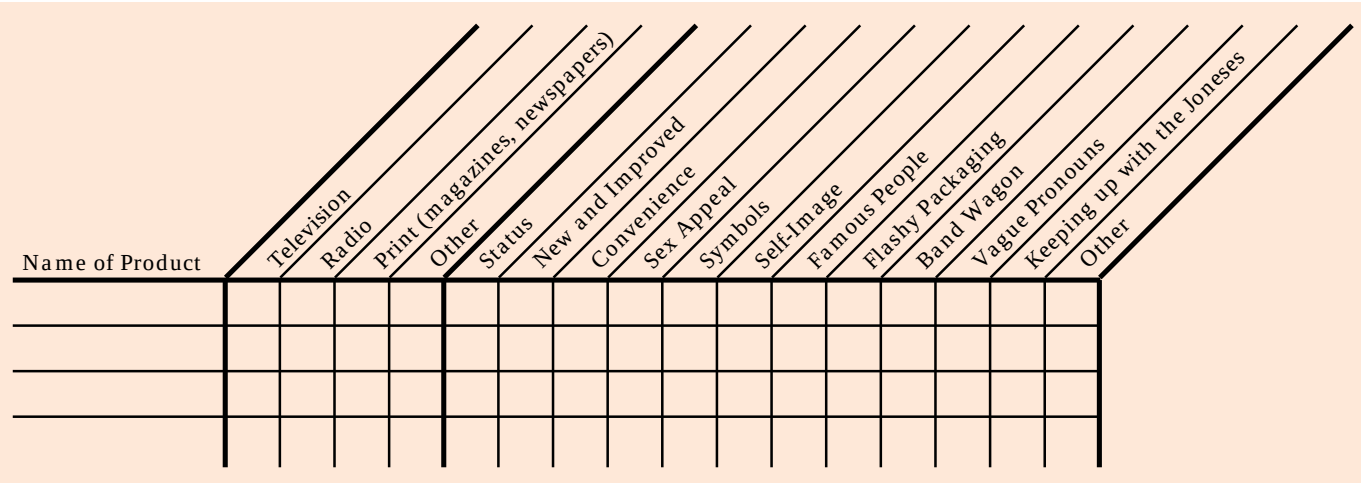
1. Find samples of different advertisements for the same type of product (soda, athletic shoes, detergent, potato chips). Select ads for different name-brands and types of packaging. Discuss:
- Which product would you buy? Why?
- What is advertising? What is the purpose of advertising?
- Does advertising influence what you buy? How?
- Which advertisement do you like best? Why?
- Do your reasons have anything to do with the quality or function of the product?
- Do you purchase name-brand items instead of generic items? Why?

2. Discuss ways in which products are promoted on television, radio and in print. Analyze at least 25 ads. Note the following:
- What strategy does the advertiser use to sell the product?
- What is the advertisement really selling: convenience? health? sex appeal? status? fun? quality?
- Does the advertisement mention the packaging?
- Is the packaging reusable or recyclable?
- Does the ad suggest what you should do with the packaging?

3. Design a chart to help analyze characteristics of these ads. A sample follows (feel free to add other categories):

4. Make a composite chart that shows the results of all the surveys done by students. Discuss:
- Which marketing strategies are used most often to promote packaged products?
- What strategies were used that were not listed on the sample form?
- What usually happens to the packaging?
- Who should be responsible for what happens to the packaging once the product is used: manufacturer? government? citizens? consumers?

Pre- and Post-Activity Questions:
- Name three reasons you buy one type of packaged product instead of another.
- How often are your reasons based on the quality or function of the product?
- Discuss ways in which advertisements may influence what you choose to purchase.



Part 3 — How Many Ways Can You Wrap An Apple?

Goal: To have students design packaging and advertising strategies to sell a product, analyze why they decided on their strategies and consider why they buy one product instead of another.

Subjects: Social studies, language arts, art, drama, environmental education.

Grades: 6-12.

Materials: An apple or other object (hammer, child's toy, batteries) for each student or group of students. Each student or group should have the same item.

Procedure:
1. You have just gotten a job as an advertising agent for an apple company (you can work either individually or with a group of other students). Your first assignment is to develop an ad campaign and packaging design to sell apples. Keep track of the reasons you chose your particular design and sales pitch. Your campaign can consist of skits, poems, songs, posters or whatever you believe will sell the product.

2. Present your ad campaign to the class.

3. Display the "products" (numbered in some way). Vote for the apple you would buy (each class member should vote anonymously on slips of scrap paper). Tally the results. Discuss:
- Why did you choose the product you did?
- How much packaging was involved in the "winning apple?" Was the packaging necessary? Why or why not?
- What influence does the packaging have on the quality of the product?
- Why was the product packaged?
- Who should pay for your packaging?
- Who should pay for disposal of your packaging?
- Were you concerned about disposal of your packaging?
- If you are primarily interested in selling the product, is it more important to package the item to sell than to package it to have low environmental impact? Are these two concepts mutually exclusive? Could you design a package that sells but doesn't use a lot of energy or resources to produce or dispose of?
- Do you have any choices about how much packaging you purchase?

Pre- and Post-Activity Questions:
- Who do you think makes decisions about what packaging to use for a product?
- What factors are consider when deciding how to make a product sell?
- Why do you think people will buy products that have a lot of packaging?
- What can you do to reduce the amount of packaging you throw away?

Part 4 — Packaging, Is It A Waste?☆

Background: A lot of energy and natural resources are consumed to produce the packaging that is used to promote, store and deliver our food, and approximately 7% of our municipal solid waste stream is food packaging. Is food packaging a waste? Or, does food packaging help reduce another large portion of our waste stream — food waste (7-10%).

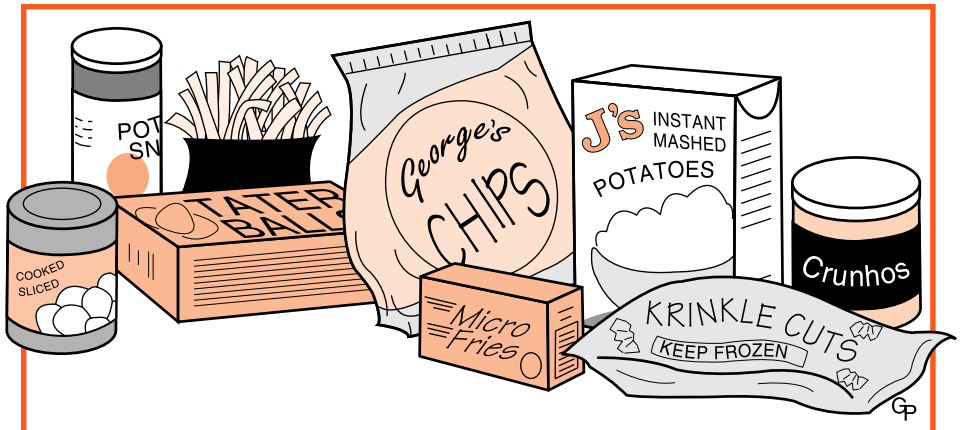
Goal: To have students consider problems associated with energy and resources expended in food packaging and the complexity of promoting, delivering and storing food in our society.

Subjects: Consumer education, family living, agriculture, social studies, language arts, mathematics, environmental education.

Grades: 7-12

Procedure:
1. Examine the following chart. Discuss:
- Which forms of the potato are most highly processed and packaged?
- Which are most expensive per pound?
- How long can you safely store the different forms of potatoes?
- Which form of potato would you purchase if you were interested in: reducing solid waste at home? saving money? convenience?

2. Consider the following quote from Dr. William Rathje, a modern-day landfill archeologist: "In terms of garbage generation, the lowly potato peel is a powerhouse among [foods]: of all food that is thrown away..., potato peels account for a mighty 7% by weight — the largest single item in fresh food repertoire." Discuss:
- Which forms of potato produce the most waste (packaging and peelings) at home?
- Which forms of potato produce the most waste at the processing plants?
- What do food processors do with their vegetable wastes? (spread in fields, compost, sell for animal feed, etc.). Are these really wastes?



This Spud's For You

Product*	Package Size	Price	Price per Pound
Fresh Idaho Potatoes	10 lb.	$3.29	$ .33
Fresh Idaho Potatoes	5 lb.	1.99	.40
Fresh Idaho Potatoes	loose/lb.	.49	.49
Sure Fine Canned Sliced Potatoes	15 oz.	.45	.52
OreIda Tater Tots	5 lb.	4.39	.88
OreIda Tater Tots	2 lb.	1.89	.94
OreIda Microwave French Fries	10.5 oz.	1.96	2.99
Order of McDonald's Value Fries	3.7 oz.	1.00	4.32
Betty Crocker Potato Buds	28 oz.	2.99	1.71
Betty Crocker Potato Buds	13.75 oz.	1.79	2.08
French's Potato Sticks	1.5 oz.	.49	5.23
French's Potato Sticks	7 oz.	1.69	3.86
Pringle's Potato Chips (reg.)	6 oz.	1.00	2.67
Jay's Potato Chips (twin pack)	13 oz.	2.79	3.43
Jay's Potato Chips (nine 1-oz. pkgs.)	9 oz.	2.79	4.96

* All items priced in November 2002, at Woodman's Grocery Store and McDonald's in Madison, WI.

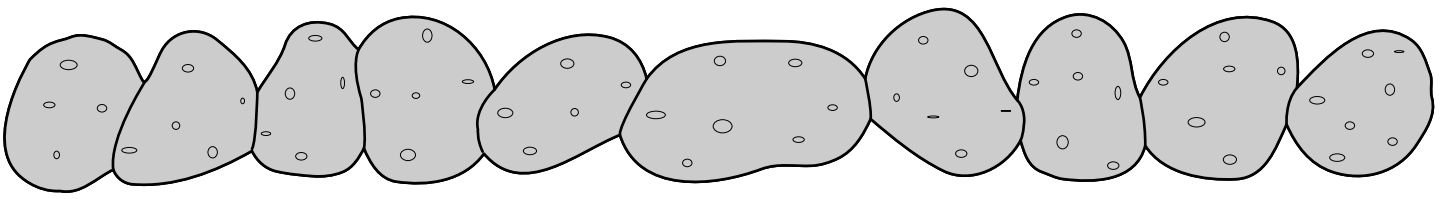
• What functions do the various forms of packaging serve?
• How can you reduce the amount of packaging and not throw away potato peelings?

3. Working with a partner, select a fresh food item to investigate, such as a tomato or corn. If possible, go as a class to the grocery store (or go independently after school). Calculate and/or record the price per pound of the fresh product as well as 5-10 items that are processed from that product. Make a chart like the potato one for the product you are investigating. Discuss:
• Which form of food item is the most expensive per pound? Why?
• What relationships are there between cost and the amount of processing and packaging?
• Which form of food item would you purchase if you were interested in: reducing solid waste at home? saving money? convenience?

4. Contact a food processing company. Find out what percentages of their costs are due to purchasing, processing, packaging, and shipping of the product. Ask them how they dispose of their production wastes.

5. Which of these products will you buy in the future? What criteria will you use for making your decisions about what to buy and what not to buy?

Pre- and Post-Activity Questions:
• What percentage of the cost of packaged foods is due to processing and packaging?
• Which of your favorite foods could you buy with no packaging? Which ones would you have to do without?
• How can packaging of foods be reduced while still addressing health and safety concerns?



Part 5 — What Can I Do To Change Packaging?

Goal: To have students identify steps that can be taken to affect the packaging options available in the marketplace and encourage them to act on an option (See activity: Time for Action).

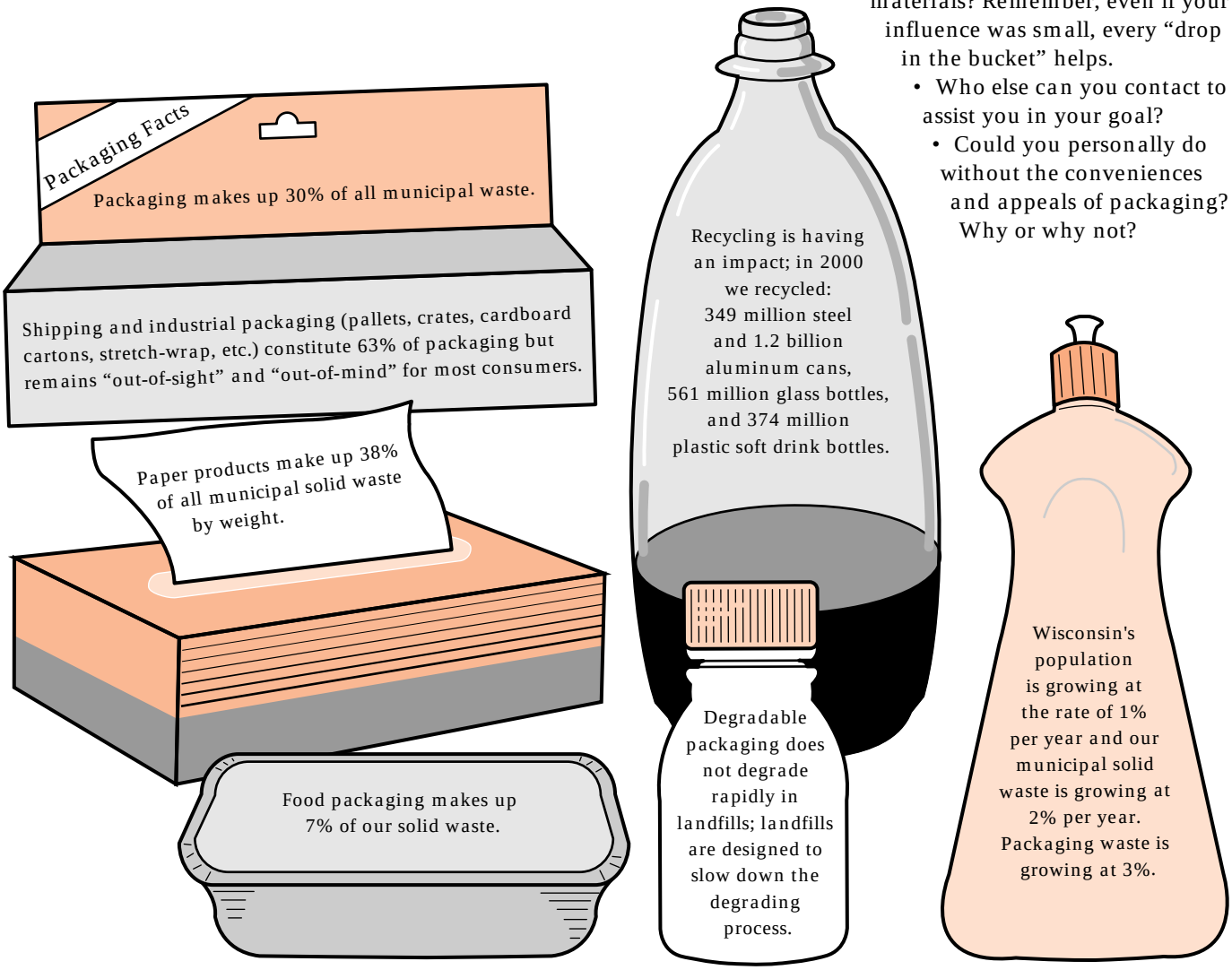
Subjects: Language arts, social studies, environmental education.

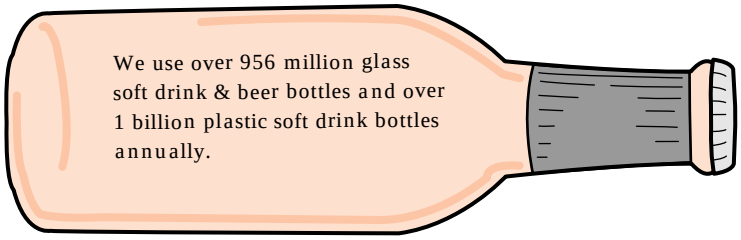
Grades: 5-12

Procedure:
1. Brainstorm what you can do to encourage change in packaging procedures. List your ideas. For example:
• Write letters encouraging retailers to carry beverage containers that can be returned or recycled.
• Write to the manufacturer of a product that seems over-packaged and express your concern. Ask them to consider reducing the amount of packaging and design packaging to facilitate recycling. Request a response.
• Write to legislators urging them to support waste reduction and recycling legislation.
• If a product's packaging has been improved (reduced packaging, made with recycled content, recyclable, etc.), write and thank the manufacturer. This will encourage manufacturers to continue these practices.
• Refuse to purchase over-packaged items in stores and tell the manager why.
• Bring your own cloth bag instead of accepting bags and extra wrappings from the store cashier and bagger and tell them why you are doing this.
• Look for and purchase products that are packaged in recyclable containers and/or made from recycled material.

2. Do some of the things you suggest.

3. Evaluate your results. Discuss:
• Did you receive a response to your letter? If not, send another copy.
• Did the response you received address your concerns and answer your questions adequately?
• Do you feel that your actions have had an influence on reducing unnecessary packaging or encouraging use of recyclable materials? Remember, even if your influence was small, every "drop in the bucket" helps.
• Who else can you contact to assist you in your goal?
• Could you personally do without the conveniences and appeals of packaging? Why or why not?





Going Beyond:

• Read the following true-life scenarios. Based on what you now know about packaging and the impact of advertising and convenience, etc., analyze and discuss what is going on in each scenario. How do you think people in these scenarios might behave differently to reduce the amount of trash they discard?

What lifestyle changes occurred over the last 30 years that affect our purchasing and disposal habits?

Scenario 1:

Mr. Jones and his young son, Sammy, are at the convenience store to buy a gallon of milk. Mr. Jones picks up the plastic jug of milk and heads for the check-out. In the meantime, Sammy has been eyeing the candy, and asks if he can have some. Mr. Jones says yes, and Sammy places his choice (individually wrapped jaw-breakers) on the counter. The clerk rings up the purchase and puts the milk jug in a paper bag. Sammy demands his own bag for his candy, and the clerk looks questioningly at Mr. Jones. Mr. Jones nods to the clerk, who gives Sammy his own bag. Once out of the store, Sammy takes his candy out of the bag and throws the bag away. Mr. Jones does the same with his bag when he gets home.

Scenario 2:

Ms. Smith has just finished mowing the lawn and asks her daughter, Kate, to help rake the grass clippings and stuff them into black plastic bags. Kate also rakes up some leaves that have blown into the shrubs. Ms. Smith and Kate haul the bags to the curb for garbage collection. Their neighbor, Carol, walks by and asks why they are putting the grass and leaves in plastic bags. Kate responds that she doesn't know any other way to get rid of them — people always dispose of them that way (she points to the house across the street, which also has thrown out grass in plastic bags). And besides, it's the way her mom has asked her to do it. Ms. Smith explains that the ads on TV said bags were good to use for throwing away garbage like grass and leaves. She bought the heavy-duty ones with the built-in tie because she had a coupon, and because the ad said they are tough and easy to use.

Scenario 3:

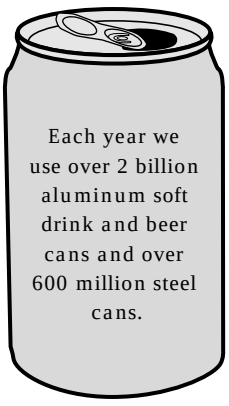
Luke and Jennifer are on their way home from school and are starving. They stop at the fast-food restaurant for a burger, fries and soda. They pay, pick up the bag with their order and go to the nearby park to eat. Luke opens the bag and takes out the sodas and paper napkins. He puts a plastic straw through the plastic spill-proof lid on his paper cup, then grabs for the cardboard container holding the fries. "You like ketchup?," he asks Jennifer, as he opens the plastic ketchup packet. Meanwhile, Jennifer is eating her burger, having stuffed the box, designed to keep the burger warm, back into the bag. She adds some pepper from the little paper packet, but decides she doesn't need the salt she got, so leaves it in the bag. When they're both finished eating, they put the garbage (from two burgers, two sodas and one french fries) in the trash can and head home.

• Purchase a large box of cereal and a variety pack that contains an equal weight of cereal. Remove (or eat!) the contents. Weigh the cardboard, foil, plastic and/or wax paper packaging. Which item (large box or variety pack) has more packaging per unit of cereal? Which costs more per unit of cereal? Why do you think it costs more? If you want more cereal for your money, which would you buy? If you want less packaging for the same amount of cereal, which would you buy? Why is cereal packaged in variety packs? Can any of the packaging be recycled?

• Talk with an older person in your community about what grocery shopping was like 50 years ago. Were the stores the same size or arranged inside like they are today (e.g., did shoppers take their own groceries from the shelf, or did the clerk do it for them)? Where did the term "supermarket" come from? Why have there been changes in the way food is marketed? Were there as many items to choose from then? Why? How were the items wrapped?

• Write down what you had for lunch and list all the containers and packaging that came with the food. Discuss the items that could be reused or recycled.

• Interview grocery shoppers to find out why they buy certain products. What do they do with the packaging? How often do they consider packaging when they make a purchase?



How Times Have Changed

Part 1 — What, No Video Games?

Goal: To have students investigate and think about how technologies, lifestyles and values change through time and how these changes alter the production and handling of wastes. To encourage students to develop a greater understanding of history and to express themselves through language.

Subjects: Social studies, language arts, science, art, environmental education.

Grades: 5-12

Materials:
- tape recorder (optional)

Procedure:
1. Imagine yourself as a reporter investigating how times have changed since your parents and grandparents were children. To help you begin thinking about how things have changed, read either Section 1 or 2, or investigate the past by consulting books, the local historical society, old magazines, antique stores, museums, etc. As you do this, think about how you'd answer the questions that follow each Section. Discuss your answers in class.

2. Interview your parents, grandparents or other adults to find out what they used in their everyday lives for toys, clothing, food wrappings, trash cans, etc. Ask how these items have changed through time and how they feel about these changes. You can either design your own interview or read Section 1 or 2 to the person(s) you are interviewing, then ask the accompanying questions. (If you have a tape recorder, tape the conversation. Be sure to ask the person(s) being interviewed if they mind being taped.)

3. Discuss your interview results in class.

Section 1: Sayings and Slogans

You've all heard sayings like:

"A stitch in time saves nine." "Waste not, want not."
"Built to last a lifetime." "Haste makes waste."
"An ounce of prevention is worth a pound of cure."

More recently, we hear slogans like:

"Quick and easy to use." "No mess, no bother." "Disposable."
"Individually wrapped for your convenience."
"They sure don't make 'em like they used to."

Questions:
- What other similar sayings and slogans can you think of?
- What are these slogans saying about our lifestyles and how they've changed?
- Which messages point out product quality? Which emphasize product convenience?
- Are products today built to be durable, convenient to use or both? Why? What do you think about this?
- What qualities in products did people appreciate when you were growing up? Has that changed over time? How?
- Did people take better care of their belongings when you were growing up than they do now? Why? How many pants, dresses and pairs of shoes did you have? What were the clothes made of? When clothes tore or wore thin, were they repaired or were new ones purchased? What did you do with old clothes?
- Can you show me a family heirloom and describe the qualities that make it so special?
- Why are we attracted to items that are "new and improved?"
- Are we more wasteful today? In what ways? Why?
- What types of things did you throw out in the trash? Were they similar to what we throw out today? If you heated with wood or coal, what did you do with the ashes? What containers did you use for trash? What did you do with trash? Did you have as much trash to throw away then as you do now?

Section 2: Toys for Us

Toys have changed through the years. At one time, most were made from natural objects. Then they were made of papier-mache, or were handmade country toys like whirli-gigs, bean shooters, yo-yos, limber jacks and tops. Over time, commercially manufactured toys became available, like wooden Lincoln Logs and Tinker Toys and metal Erector Sets. Then plastic toys came on the market — toy guns, frisbees, hula hoops and plastic models. Now, battery-operated and electronic toys, pinball games, video games and computers are popular.

Questions:
- What were your favorite toys when you were little? How many toys did you have?
- What were your toys made of? Who made them?
- How long did your toys last? Could they be fixed if they broke? Would it have been cheaper to fix the toy or get a new one? Why? Could you fix a broken toy at home or did someone else have to fix it?
- If broken toys could not be repaired, what did you do with them?
- How are toys sold today different from those you had?

Part 2 — The Garbage Guzzler Strikes Again

Goal: To have students investigate and think about how technologies, lifestyles and values change through time and how these changes alter the production and handling of wastes. To encourage students to develop a greater understanding of history and to express themselves through language.

Subjects: Social studies, language arts, science, art, environmental education.

Grades: 4-7

Procedure:
1. Read the unfinished story "The Garbage Guzzler Strikes Again."

2. Write a final paragraph that describes what the Garbage Guzzler dumped in Jody's backyard. Read and discuss your concluding paragraphs in class.

3. Discuss possible answers to the questions that follow the story. Did your endings answer some of these questions?

4. For an art assignment, draw your image of the Garbage Guzzler.

Questions:
• From what dates in history did the Garbage Guzzler collect garbage?
• What items might Sam and Jody find in each garbage pile?
• What are these items made of?
• How many of the items do you think would be recyclable?
• Compare the items in the different piles. What do the differences indicate about the lifestyles of people at each location and each period in history? What might people from each period in history think about the garbage from other periods?
• What will happen to the items if they stay in Jody's backyard for a year? ten years? fifty years?
• What predictions do you have for what we will be throwing away in ten years? fifty years?

The Garbage Guzzler Strikes Again

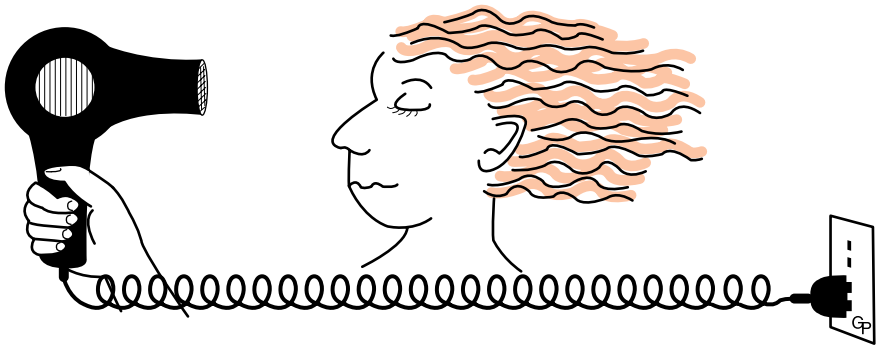
Sam and Jody's teacher has given their class an assignment to write about recycling and how the stuff Americans throw away has changed throughout history. Sam and Jody are having a tough time with the paper. Lucky for them, the Garbage Guzzler suddenly appears and offers to lend a hand!

The Guzz picks up the empty trash can behind Jody's house and takes off in his Time Machine. Sam and Jody have no idea what the Guzz is up to. Are they surprised when he returns with a can of garbage he collected from a Pilgrim's house in Plymouth, Massachusetts! The Guzz makes three more trips in the Time Machine, returning with garbage collected from a Philadelphia house during the meeting of the first Continental Congress, from a miner's shack near Sutter's Mill during the California Gold Rush and from a Wisconsin house the day after Mount St. Helens erupted. He dumps all four piles of garbage in separate piles in Jody's backyard.

Sam and Jody are amazed by what they see in each pile. The Pilgrims had thrown out...

• What predictions do you have for the amount of trash we will throw away in ten or fifty years compared to how much we throw away now?
• Is there anything you can do to influence what trash will be like or how much trash there will be?

Going Beyond:
Consider how other products we use in our homes have changed through time. Discuss:
• What did people do before there were products like Scotch tape, hairdryers, toilet bowl cleaner, soda cans, toothpaste tubes and pumps, plastic cups, power lawn mowers, disposable diapers, plastic wrap, vacuum cleaners, plastic shampoo bottles, microwave ovens, etc.? Can you do without these today?
• What did they do with their leaves and garden clippings before there were plastic bags?
• How do changes in technology affect our living habits, our waste habits, our opportunities for recycling and our environment?



The Cost of the Toss

Part 1 — Decisions, Decisions

Goal: To have students develop a better understanding of what options exist for managing solid waste and the costs and benefits of each option.

Subjects: Social studies, mathematics, environmental education, science, health.

Grades: 6-12.

Procedure:

1. Imagine yourself as the mayor of Wonderful, Wisconsin. Yours is a pleasant city of 65,000 people. Unfortunately, Wonderful is in the midst of a not-so-wonderful crisis: your landfill must be closed because it doesn't comply with present standards for protecting the environment. What's Wonderful going to do with all its garbage?

As mayor, you're responsible for investigating new options for managing Wonderful's solid waste. You begin by forming a solid waste committee to study the options. Who do you think should sit on this committee (town treasurer, public works director, citizen representative, landfill developer, etc.)? Assign fellow classmates to play these roles and decide on a name for your committee.

2. Call a meeting of the committee. Your assistant has prepared the chart, "Managing Garbage From Homes," to help members see some options and impacts of managing garbage for Wonderful's homes. Study the chart and, as a group, consider the following questions:

• At first glance, which waste disposal option seems best? Why? Do you all agree? Is there one best option?

• What criteria and values are you using to judge options? Are you pro-business, pro-taxpayer, pro-environment, pro-convenience? Discuss how your personal points of view might influence how you judge the importance of each potential impact.

• For how many years into the future are you planning? Why is this an important consideration (population growth, long-term economic and environmental impacts, etc.)?

• How big is 52,000 cubic yards? How much space will you need if you choose to landfill Wonderful's garbage for that many years?

• Compare the pros and cons of citizen convenience and environmental impacts for each option. Do you consider citizen convenience more important than environmental impacts or vice versa? Why? How does your view affect which option you think is better?

• What is the relationship between net cost and citizen convenience? Is what's convenient the least/most expensive? If saving money is your main concern, which option would you choose? Should saving money be your only concern?

• Does this chart calculate in the "costs" of each option's long-term environmental impacts or use of natural resources? What might these "costs" be? How much should your committee be concerned about these "costs" in making your decision? How easy is it to put a dollar value on environmental damage?

• If creating jobs is high on your list of priorities, which option would you choose? What do you think about the often-made statement that recycling eliminates jobs?

• You have read somewhere about composting municipal solid waste. Where can you find out more about composting? Why might your community consider composting as a valid option for waste disposal? Which wastes could be composted?

• What are the pros and cons of incineration? Do you think the benefits (landfill space saved, energy produced, convenient) outweigh the costs (landfill still necessary, toxic ash and air pollutants produced, expensive)? What are the experiences of other communities that already have installed incinerators? How do the pros and cons of incineration compare with those of recycling?

• Recycling newsprint sounds like a great way to save landfill space and trees. But you've heard that some newspapers use ink that contains lead, a hazardous metal. What happens to this lead when the paper is landfilled? recycled? composted? burned? What have newspaper manufacturers substituted for lead inks?

3. Investigate what is required by your local, state, and federal governments for choosing the waste management option(s) for Wonderful (e.g., public hearing, citizen referendum, DNR approval, environmental impact statement).

4. Do you feel you have enough information to make a wise decision for your town? If not, where can you find this information?

5. Now that your committee has investigated and discussed the options for Wonderful's solid waste management plan, make a decision about which option(s) the town should enact.

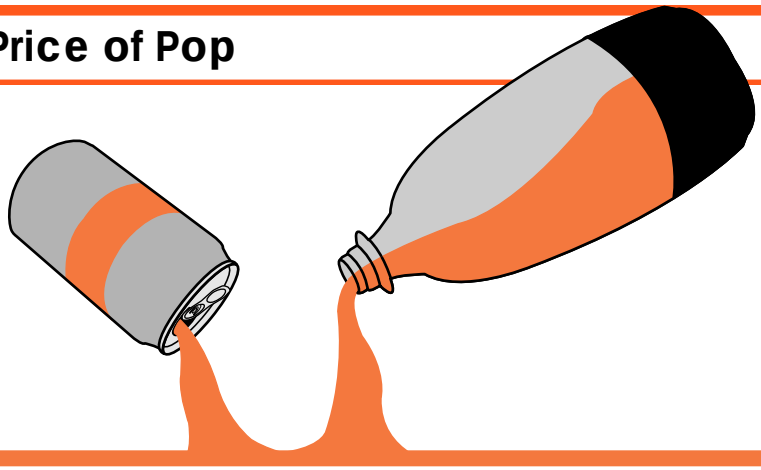
6. List suggestions for what you can do to ensure the success of Wonderful's new waste management plan (e.g., community education, providing containers for recycling).

Managing Garbage From Homes: Options & Impacts*

Option	No. of employees	Landfill needs/yr. (cubic yards)	Net Cost ($/yr.) (includes sale of any energy produced)	Amount of Energy (gallons of gas equivalent)	Environmental Issues	Citizen Convenience
a)Landfill everything (landfill 15 mi. away)	Collection 40 Landfill 2 Total 42	52,000 yd3	Collection $1,300,000 Landfill 520,000 Total $1,820,000	Collection 30,0000 Landfill 13,000 Total Used 43,000	— is unattractive — uses land — can pollute water & air — can create hazardous gases (methane) — bury/lose natural resources	— just put waste at curb
b) Voluntary Recycling Curbside pickup of: glass, newsprint, plastic, cans. Landfill remainder	Collection 44 Recycling center 8 Landfill 2 Total 54	47,000 yd3	Collection $1,400,000 Recycling (10,000) (profit) Landfill 470,000 Total $1,860,000	Collection 33,000 Recycling (300,000) (saves) Landfill 12,000 Total Saved (255,000)	— reduces impacts at landfill — reduces pollution from manufacturing — reuses natural resources	— need to separate recyclables — builds good habits
c)Mandatory Recycling (as in “b” above)	Collection 48 Recycling center 15 Landfill 2 Total 65	42,000 yd3	Collection $1,500,000 Recycling (60,000) (profit) Landfill 420,000 Total 1,860,000	Collection 36,000 Recycling (600,000) (saves) Landfill 9,000 Total saved (555,000)	— same as voluntary recycling above — requires enforcement for non-compliance — builds good habits	— need to separate recyclables
d)Mandatory Composting of yard waste. Landfill remainder. (assume yard waste is composted at home)	Collection 42 Composting 1 Landfill 2 Total 45	45,000 yd3	Collection 1,350,000 Composting 50,000 Landfill 450,000 Total $1,850,000	Collection 33,000 Composting 1,000 Landfill 10,000 Total used 44,000	— reduces need for landfill — reduces methane gas pollution — reduces strength of leachate — produces fertile humus — reuses natural resources	— need to separate yard waste — builds good habits
e)Incinerate for energy recovery. Landfill ash & non burnables (incinerator in town)	Collection 38 Incinerator 12 Landfill 1 Total 51	10,000 yd3	Collection $1,250,000 Incineration 750,000 Landfill 200,000 Total $2,200,000	Collection 28,000 Incineration (840,000) (produces) Landfill 2,000 Total (810,000) Produced	— reduces need for landfill — produces fly ash high in heavy metals that requires special handling — produces air pollutants — consumes natural resources	— just put waste at curb

*Example compares costs for a community producing 100 tons/day, 5 days/week.
Numbers presented are realistic (1986) but not specific to any one community.
Other options and combinations of options exist.

Part 2 — Paying the True Price of Pop



Goal: To have students develop a better understanding of what options exist for managing solid waste and the costs and benefits of each option.

Subjects: Social studies, mathematics, environmental education, science, health.

Grades: 6-12.

Procedure:
1. Bring pop containers made of different materials to class to help you focus your inquiry on real objects. Discuss:
• What materials are your containers made of?
• How might this determine how you should dispose of them?
• What do you think are the best ways to manage the future of your containers? Why?
• How much of the cost of the pop do you think is packaging? How much is the cost of the pop itself?

2. Study the information in the chart "Paying the True Price of Pop". Discuss:
• How much of the cost of the pop is packaging?
• Is the cost of the packaging a fair price to pay for the delivery of the pop?
• Who should be responsible for its disposal?

3. List the possible disposal options for these containers. What are the associated costs and benefits? Consider waste management impacts on economics, energy use, environment, jobs, etc. For example:
• Who pays for the cost of disposal?
• What impacts might the disposal of your containers have on the environment? Who pays for the long-term environmental impacts of waste disposal?
• Does any disposal option have an impact on energy? Are there any energy savings? How much?
• If you are concerned about reducing solid waste in your town, then which container(s) would you buy?

Paying the True Price of Pop*

	Product Size	Package Price	Price per 8 oz.
Two Liter Plastic Bottle	67.6 oz.	$.99	$.12
Six-Pack 16.9 oz. Plastic Bottles	101.4 oz.	2.09	.16
12-Pack 12 oz. Cans	144 oz.	3.09	.17
24-Pack 12 oz. Cans	288 oz.	5.69	.16
Six-Pack of 8 oz. Glass Bottles	48 oz.	3.79	.63

* All items priced on April 12, 1993, at Woodman's Grocery Store in Madison, WI.

Going Beyond:
• Investigate how your town disposes of its solid waste. How much is landfilled, recycled, composted, incinerated? What plans does your town have for handling solid waste in the future? What do you think about these plans?

• Contact your trash hauler to find out the total costs of collection, transportation and disposal per ton of solid waste. Discuss:
a) If your family produces 3.4 tons of trash each year (the average for a family of four), then how much should your family pay for trash removal service? How does this compare to the cost of cable TV, the newspaper, or a six-pack of soda a week?
b) How much does your family pay each year for trash service?
c) Do you think the cost for the care of your solid waste is reasonable or unreasonable? Why?
d) Would you be willing to pay more to dispose of your trash? Why or why not?
e) How does the amount your family pays for its trash service compare with amount it pays for water or sewage service?
f) Would you be willing to recycle some household trash items if your town made it easy (provides drop-off or curbside service)?

• Investigate how society subsidizes some methods of handling waste. What do you think about such subsidies? For example:
a) Do your property taxes or waste disposal fees fully cover the cost of your landfill?
b) Does the government give tax breaks for use of virgin materials? recycled materials?
c) How many of your tax dollars are spent on educating citizens about recycling and composting?

Time For Action

Goal: To help students understand the process of taking environmental action. To have them identify a specific waste management problem in their community, design a research question addressing it, conduct the research and decide how and whether to take action to help solve the problem.

Subjects: Social studies, science, language arts, environmental education.

Grades: 7 - 12.

Procedure:

1. What are several key solid waste management issues in your community? Find out about them by reading local newspapers, attending meetings of solid waste planning groups, talking to municipal or state solid waste managers, finding out the viewpoints of local environmental groups or reviewing local budgets for hauling and disposing of trash.

2. Select a local solid waste issue to investigate individually or as part of a small group. Focus on an issue that can be investigated within a reasonable amount of time. For example:

- What can be done if the local landfill is almost full?
- Is incinerating waste for energy an economically and environmentally sound management option?
- What steps could you take to reduce the amount of solid waste you make at home?
- How can people be informed about changing their buying and living habits to reduce how much they throw out?
- How much does the community spend handling trash compared to the budget for education, recreation, snow removal, police and fire protection or housing for the elderly?
- How do different fast food restaurants compare in what and how much waste they generate?
- How much methane gas is generated from solid waste? Is methane gas a problem? What are possible solutions?
- How much water falls on a landfill during the year? How much of this becomes runoff and leachate? What is done with the runoff and leachate?
- What are the pollutants in leachate? What are the sources of these pollutants? Which are the most harmful?

3. Define your issue as precisely as possible, develop a research question(s) and conduct the research to answer your question. Possible research techniques for collecting data to help answer the question(s) could include telephone interviews, development and use of surveys and questionnaires, and use of both primary and secondary references.

4. Prepare a research report to present in class. The report should include a description of: a) the issue, b) the research question, c) the method of investigation, d) the data gathered, e) how you analyzed the data, f) what conclusions you made from the study (both the knowledge gained and what value that knowledge has) and g) what concepts, values and beliefs influenced why you asked the question, why you selected the research method, and how you interpreted the results.

5. Questions to consider as you investigate your issue and before you decide to take action include:

- Who is involved in the issue and what are their beliefs, values and attitudes?
- What are my beliefs and values about this issue?
- What specific types of action will I take? (persuasive, consumer, political, legal, direct, and/or personal action?)
- Is there sufficient evidence to warrant action on this issue?
- Are there alternative actions that I could take?
- Is the action I chose the most effective one available?
- What are the legal, social and economic consequences of this action?
- Do my personal values support this action?
- Do I understand the procedures necessary to take this action?
- Do I have the skills needed to take this action?
- Do I have the courage to take this action?
- Do I have the time needed to take this action?
- Do I have all of the other resources needed to make this action effective?
- What are the ecological consequences of this action?

6. If you decide to take action, choose strategies for which there is a likelihood of success within a realistic amount of time. For example:

- Survey litter production on your block, instead of surveying litter production in your entire town.
- Begin by writing letters to the editor of the local paper encouraging people to recycle, instead of aiming to convince the city council to start a mandatory recycling program. You might try to get editorial support for your viewpoint.
- Before trying to set up a community recycling center, see if your family is willing to recycle household wastes for a few months.

7. Add a conclusion to your report that describes the action you took and any results.

More Activity Ideas!

• Invite a member of your city's common council or county board to talk about how solid waste disposal and community recycling decisions are made. Consider giving your guest a list of questions you would like answered before he/she comes to your class.

• Attend a common council or county board meeting to observe local politics in action.

• Note what people in your neighborhood throw out on trash day. Do you see items that could be reused or recycled (e.g. window frames, old appliances, chicken wire, plastic plant trays, grass clippings, leaves, glass bottles, wood scraps)? Why do you think these items are being discarded instead of given away, recycled, or reused? What might you do about this? (e.g., offer to take materials to or contact Goodwill, Salvation Army, recycling companies; hold a yard sale; find others who could use the materials, etc.)

• Read the Dr. Suess story, The Cat in the Hat Comes Back. Discuss the concept of "away." Is there such a place? What do you think about the Cat in the Hat's solution?

• Investigate the United States' nationwide efforts to recycle during World War II. What was recycled? Why was recycling during the war so successful? Why is it harder to get people to recycle now?

• Collect and discuss examples of objects that can be reused in ways different from their original purpose.

• Visit a car salvage yard to learn what parts of junked cars are reused or recycled. Note how changes in car design and materials have changed what's considered recyclable.

• Conduct a litter survey of your neighborhood or school grounds.

• Examine the pros and cons of using returnable beverage containers. What states have "*bottle bills*" (beverage container deposit laws)? Contact one or more of these states for information about how the legislation was accomplished politically, how it has been implemented and what impacts it has had on recycling, litter, jobs, public opinion, energy use, etc. Contact Wisconsin legislators, businesses, agencies and organizations and ask for their viewpoints and reasons for supporting or opposing beverage container deposit laws in Wisconsin. What do you think about a state or federal bottle bill?

• Collect photographs of life in other countries. Which countries do you think have the greatest solid waste problems? Why?

• Brainstorm ideas for how you can help reduce solid waste.

• Write slogans and make posters about solid waste problems and solutions.

• Think about how you feel about solid waste — is it ugly or pretty? A problem or not?

• Ask every student in your class to pick up a piece of litter on the way to school. What is litter? What items often end up as litter? Why? How much of what you collect could be recycled? How do you feel about litter? How do you feel about collecting it? Why do we have a litter problem? What is meant by the slogan, "Every litter bit hurts?" Is littering common in other countries? What is different about countries where littering is not common? What suggestions do students have for helping solve the litter problem? Are the suggestions realistic and something you will do?

• Find out what the solid waste management laws are in your community. What are they designed to do? What do you think of them? Do they work well? If not, do you have suggestions for how they could be better?

• Consider the fact that the United States has 6% of the world's population, but uses over 25% of the world's natural resources. What do you think about this?

• Conduct a survey of several fast food restaurants and record the types of packaging (e.g., polystyrene, paper, aluminum foil) they use for similar items (e.g. soda, plain hamburger, fish sandwich, french fries, coffee). Is the packaging necessary? What criteria are you using to make your judgement? If you were concerned about the impacts of solid waste on the environment, which restaurant would you patronize? Could you influence the restaurant to change its packaging policies? How?

• Go to a fast-food restaurant and ask to be served a drink in your own cup or a hamburger on your own plate. Will/can a fast food restaurant serve you? Why or why not? What would people think of you if you asked to be served in this way? What are the health requirements for serving fast foods? Why were these rules made?

• Investigate what manufacturers are doing to reduce the amount of packaging for their products. Report findings to your class.

• Call a manufacturing plant and find out if they are preventing waste through *source reduction*.

• Visit your local solid waste disposal service to learn how it disposes of your community's waste. Visit your local recycling center.

• Gather trash from school or home and design useful objects from it (musical instruments, toys, bird feeders, planters, door stops, etc.) For ideas, write for *Ranger Rick's Nature Magazine Recycling Reprints* (see Resources).

• Examine contents of the classroom trash can at the end of the day. Record each piece of trash as it's removed. Can you reconstruct the day's activities from the clues in the trash can? Are any of the items recyclable?

• Investigate why archaeologists and anthropologists are interested in old garbage dumps. What can studying the contents of old dumps tell us about earlier peoples? What is an Indian midden? What do you think people in the year 3000 would think about our culture if they were to do an archaeological dig in our landfills?

• Select and analyze an article about solid waste management from your local paper. What is the headline? Who, what and where is the story about? What are the conclusions? What do you think about the article? Does it present the facts you need to understand the issue? Does it interpret the facts well? Is it well written?

• Conduct a school or neighborhood yard sale to reuse unwanted objects. What do you think about the saying, "One person's trash is another's treasure?"

• Take a field trip to a nearby woods or old field. Look for evidence of nature's recycling processes. For example, find natural objects that are decomposing (e.g. dead plants and animals, animal droppings, feathers, fur, etc.) and what "decomposers" are assisting this process (e.g. fungi, insects, molds, etc.). Investigate what you find carefully, and discuss what you saw, smelled and felt. Why is decomposition such an important natural process?

• Visit a paper or plastic manufacturing plant. Does the plant use only virgin materials, or does it use recycled instead? What are the pros and cons of manufacturing from virgin materials vs. recycled materials?

• Investigate the Wisconsin tax advantages/disadvantages of using virgin materials vs. recycled materials to make paper. What do you think about these tax laws?

• Investigate how newsprint in your community is recycled. Do many people recycle their newspaper? Why or why not?

• Consider why we've shifted from glass milk bottles delivered at the door to plastic or plastic-coated paper containers purchased at the store? What are the economic, environmental and social impacts of this shift?

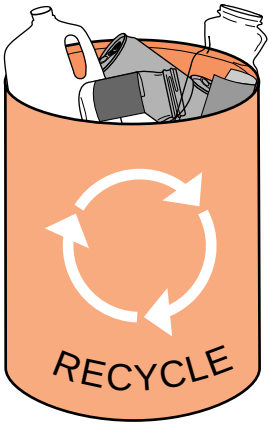
• Place 20 objects, both natural and human-made, on the floor. Name the objects and decide if they are natural or human-made and why. How completely do natural objects decompose compared to human-made ones? Which objects are more likely to release harmful chemicals to the environment as they decompose? Research your guesses.

• Find out about ways in which litter harms animals. Investigate the often fatal impacts of: discarded fishing line and plastic six-pack holders on water birds (they can get tangled); old soda or beer bottles on shrews and other small mammals (they enter a tilted, slippery bottle and can't get back out); flip-tops on fish (small fish can get stuck in the rings); and cigarette butts, tin cans and other litter on deer, raccoons and other mammals (they eat the litter or can cut their tongues on sharp edges). Humans also can be hurt. Have you ever cut your foot on broken glass or a discarded nail? Think of other ways that litter can harm people and other animals. How can such problems be prevented? Contact your state legislator for an update on Wisconsin laws that address these problems.

• Contact a glass manufacturing company and ask for an estimate of the amount of energy required to produce, recycle and reuse a ton of glass bottles. What other costs should be considered when choosing which strategy for handling glass is best (e.g., costs of collection and transportation)? What do you think your family should do with its glass? How much energy would your actions use/save? Should we recycle bottles to save energy? Why? What impacts might this have on jobs, the environment, trash removal costs, etc.?

• Set up a recycling plan for your school. Determine what can be recycled, find sources for the recyclable materials, establish a procedure for recycling, elicit support from school organizations (e.g., service clubs could help coordinate the plan, technology education class could make or design recycling bins), discuss your plan with school administrators and present your proposal to the school board. Enact your recycling plan.

• Investigate what happens to old tires. What are the problems associated with tire disposal? Research the causes and effects of the tire fire that began in Somerset, WI, on October 18, 1986. What sources of information can you consult to find out about the fire?



Resources

General

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Recycling Facts and Figures. 2003. Publ. CE-163. Communication and Education, Wisconsin D.N.R., Box 7921, Madison, WI 53707.

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Agencies and Organizations

Associated Recyclers of Wisconsin, http://www.arowonline.org

Wisconsin Department of Natural Resources, P.O. Box 7921, Madison, WI 53707. (Recycling Education Coordinator, Bureau of Communication and Education, 608-266-2711; Recycling Team Leader, Bureau of Waste Management, 608-267-7550)

Wisconsin Merchants Federation, 1 East Main St. St., Madison, WI 53703.

University of Wisconsin-Extension, Solid and Hazardous Waste Education Center, Lowell Hall, 610 Langdon St., Rm. 529, Madison, WI 53703; also, contact your County Extension office.

The purpose of Department of Natural Resources study guides is to help increase Wisconsin citizens' knowledge about and understanding of our state's environment. We hope to provide information about important environmental issues, encourage respect for the environment and help citizens become active stewards of our natural resources.

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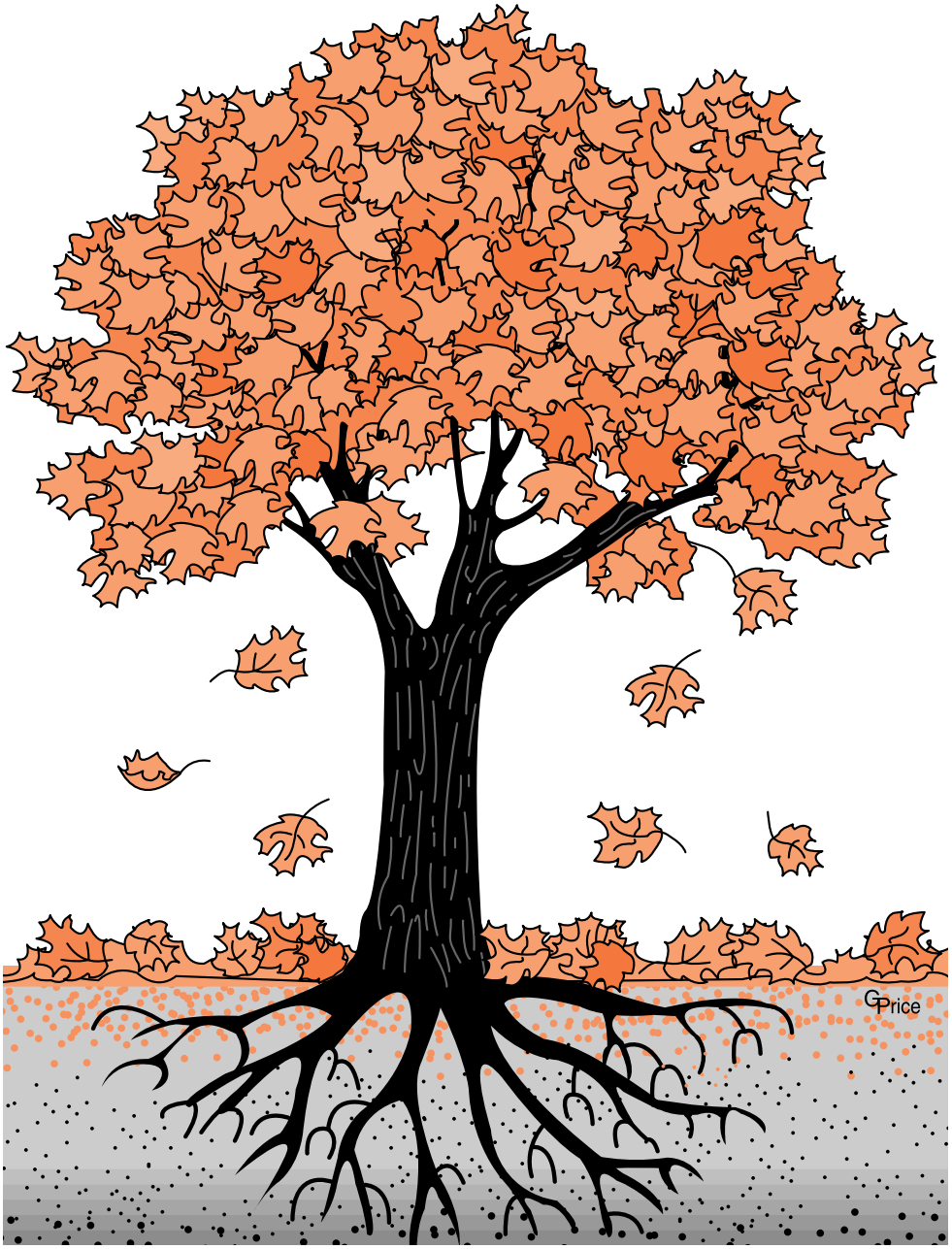

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